XI

THE TOOL ENGINEER

CIAL PUBLICATION: AMERICAN ASTE SOCIETY OF TOOL ENGINEERS

Behind every manufactured product is the tool engineer

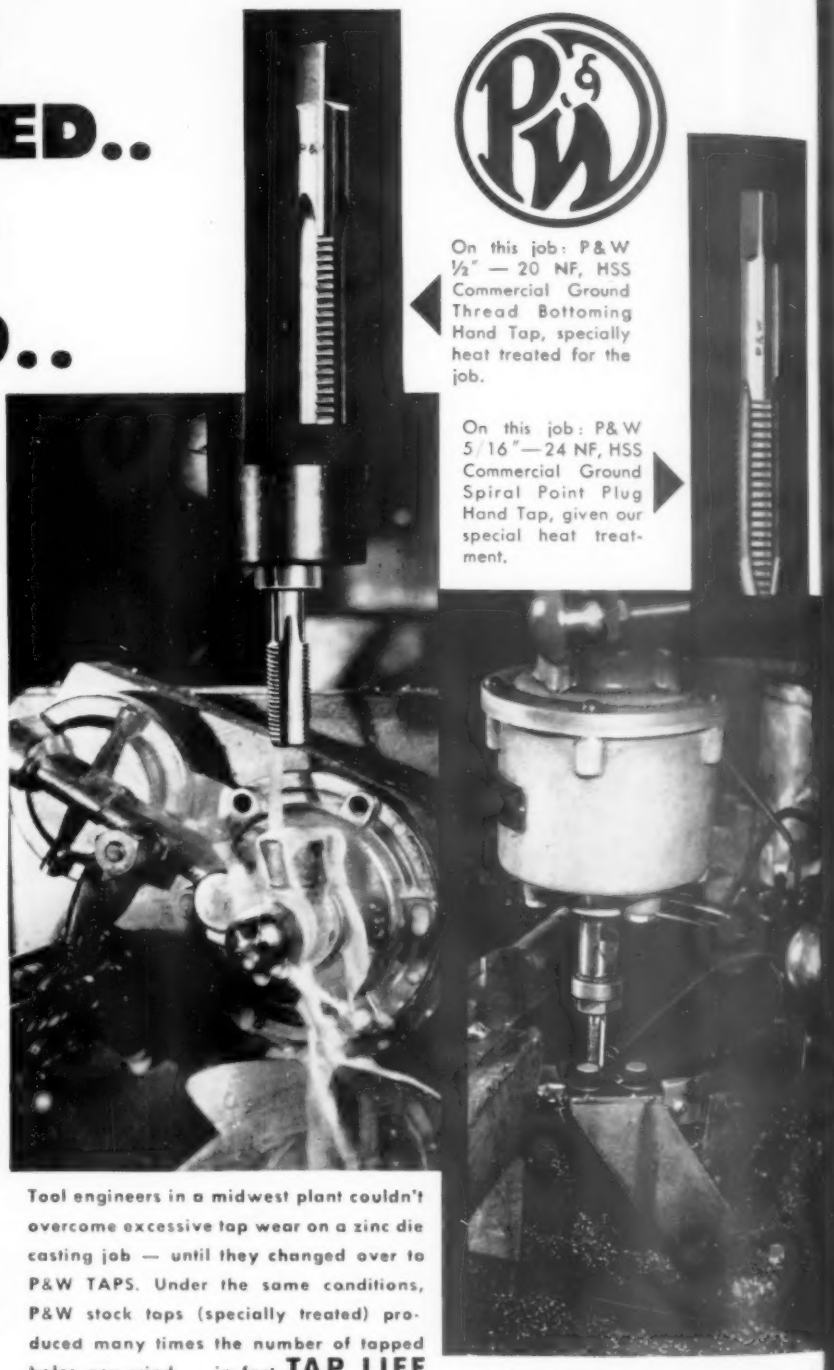
TAP LIFE INCREASED..

TOOL COST DECREASED..

with

P&W TAPS

Here are two widely separated jobs that *prove* there's a difference in Taps. In each case, the comparison is based on the same operation, the same material, the same machines. The only difference — *and a BIG difference* — is in the *"make"* of Tap. P&W "know how" in design, precision manufacture and special treatment gives more tapped holes per Tap — a plus factor on any job.



On this job: P&W ½" — 20 NF, HSS Commercial Ground Thread Bottoming Hand Tap, specially heat treated for the job.

On this job: P&W 5/16"—24 NF, HSS Commercial Ground Spiral Point Plug Hand Tap, given our special heat treatment.

HERE'S ONE INSTANCE

Tool engineers in a midwest plant couldn't overcome excessive tap wear on a zinc die casting job — until they changed over to P&W TAPS. Under the same conditions, P&W stock taps (specially treated) produced many times the number of tapped holes per grind . . . in fact **TAP LIFE INCREASED OVER 300%**

. . . HERE'S ANOTHER

A New England tool and die company has been tapping in cold rolled steel, obtaining only a few thousand holes per tap. P&W TAPS were applied to the same job with the same equipment. **RESULT: TAP LIFE INCREASED 270%**

It pays to buy Taps on a Performance Basis

Pratt & Whitney

Division Niles-Bement-Pond Company
WEST HARTFORD 1, CONNECTICUT

P&W TAPS

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November, 1949

Vol. XXIII No. 5

Editorial

The Fulfillment of Responsibility

What responsibility has management today?

THE ANSWER TO THIS seemingly simple question lies deep in the past of the industrial movement, and through each cycle of popular attitude a different, if not necessarily new answer has resulted.

The current discussion of pensions for workers of retirement age is a reflection of presentday attitude toward this question: there is an increasing belief that management, representing industry, has a definite responsibility to its workers (labor) beyond that assumed in the past.

Management has historically assumed a prior responsibility toward its stockholders: to return to them dividends on their investment consistent with good management, and to protect their equity through efficient stewardship. Thus the stockholder has consequently felt that any move which reduced the former or endangered the latter was contrary to his interests, and therefore a violation of that responsibility.

But in recent years, because of the complexity of our industrialized economy and the concentration of many workers into fewer companies, many new problems have arisen. Public and community relations, professions unheard of a few decades ago, have achieved an important status with the corporation. Since whole communities have grown dependent often on a single corporation, management has felt a responsibility toward the community and, in effect, its citizens who are the employees of the corporation.

Thus, although in a great many cases we have a large overlapping, there result three groups claiming equal or prior allegiance from management: stockholders, labor and the community. Which deserves prior consideration, or is there a need for extreme attention to any?

In most cases we have accepted the idea that, in keeping with the historical right of the stockholder, the highest return is not necessarily the wisest. This is seen in the need for reserves and growth funds of the modern corporation, and the provision for these before distribution of dividends.

Therefore, is the earmarking of certain funds for the other two groups, and the provision for them before payment of dividends a legitimate function of management? Or should we consider that this responsibility to workers and the community be served in the same light as the stockholder dividend: a return consistent with good management, which of course would vary with economic conditions.

It would seem that somewhere between these two thoughts lies a point which is in the best interests of stockholders, workers and the community. Can we be intelligent enough to find it?

R. B. Douglas

President 1948-49

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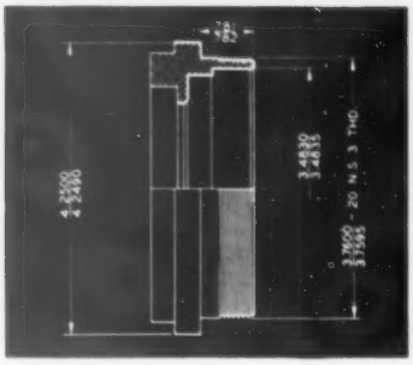
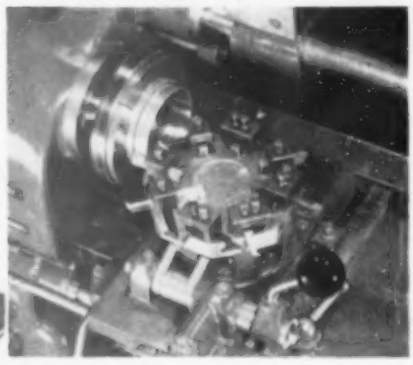
Spindle Speeds to 3,000 r.p.m.

Here is an example of precision production work easily handled by the new Hardinge Multi-Operation Chucking Machine — in one chucking, twelve surfaces were finished with single point tools to specified tolerances in addition to the threading operation. The tooling was entirely standard, using standard tool bits, step chuck and lead screw. Three of the precision machining operations are illustrated at the right together with the blueprint of the part.

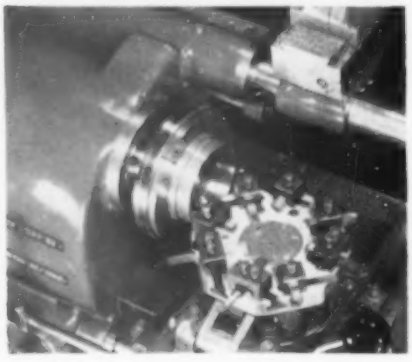
Send for FREE illustrated bulletin.



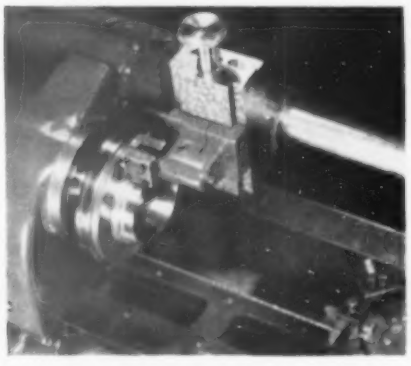
A typical part from rough blank, finished on twelve surfaces (indicated by heavy white lines) and threaded to specified tolerances.



Turning — close-up view showing the part held in a standard step chuck. Threading head withdrawn to give ample space for free turret operation.



Boring — note the simple standard square tool bits; and closeness of turret to work.



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"We increased speed from 80 to 119 rpm and tapped 3,500 holes with no dulling of tap.

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Advantages all spell ECONOMY

Consider that use of DuBo Plug Gages results in time saved because of their ease of entry . . . add cost savings through the elimination of parts needlessly rejected and the reduction of parts incorrectly passed . . . add speedier, surer handling of work . . . add long, consistent service . . . and you'll agree that for your fixed limit gaging DuBo Plugs lead the way to lower costs.

SELF-PILOTING — Utter ease of entering is a real and definite time-saver. Relieves nervous strain of fussy positioning.

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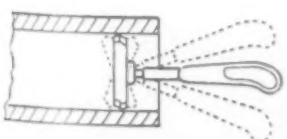
NOW — CHROMIUM PLATING is available on the gaging surface, adding a tremendous plus to an already long service life. Extra cost is small for the increase in wearability. Write for details of Chromium Plated DuBo Gages and chromium plating salvage service.



Operates by tilting handle, without force. Whether handle drops freely or not is the definite yes-or-no indication.

This new illustrated folder will tell you more about the cost saving features of DuBo Gages. Yours for the asking.

*U. S. and Foreign Patents Granted

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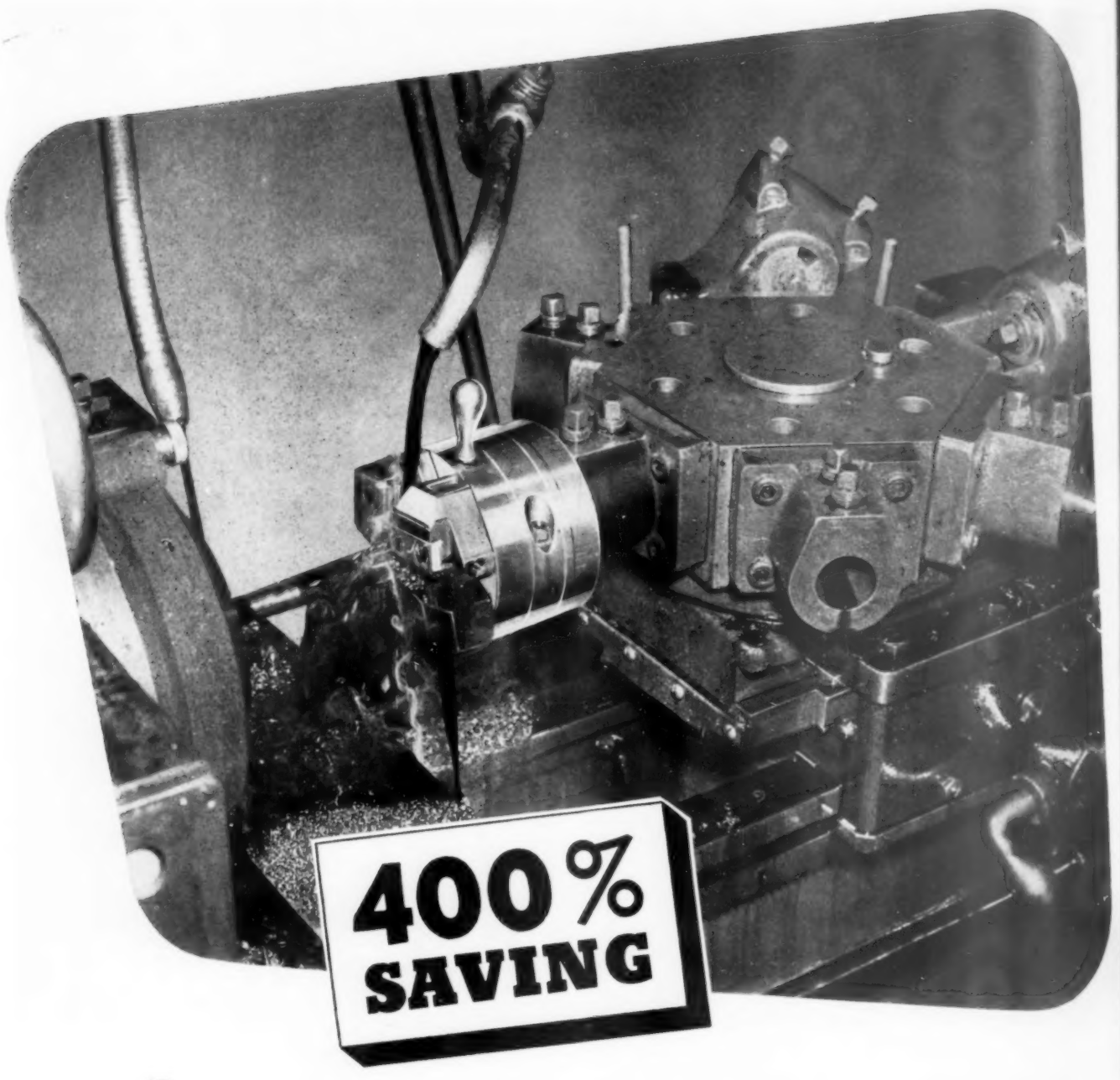

TIME Study and Methods Department records of a large aviation equipment company furnish data of another job where LANDMATIC Heads have effected large savings in machine time and improvements in product quality.

In this operation, the 1¼" LANDMATIC Head on a turret lathe equipped with Lead Screw Attachment is cutting a 5/8-6 Acme thread on a Stabilizer Screw used by a light aircraft manufacturer. The thread was held to the close tolerance of ±.001 between the P.D. of the thread and the O.D. of the screw, for a full thread length of 5-3/8" on cold-drawn piston stock, Spec. #AISI, B1112.

The thread is now cut in one pass in .192 minutes with a spindle speed of 230 R.P.M., giving an average of 400 pieces per chaser grind. This is a saving of approximately 400%. Former methods required two passes—one roughing and one finishing cut—and hand fitting with the mating nut was necessary in assembly.

LANDMATIC Heads are stationary threading heads with self-opening action designed primarily for turret lathes. Their unusually-large oversize capacity makes them ideally suited for these machines. For detailed information and specifications, write for illustrated Bulletins F-80 and F-90.

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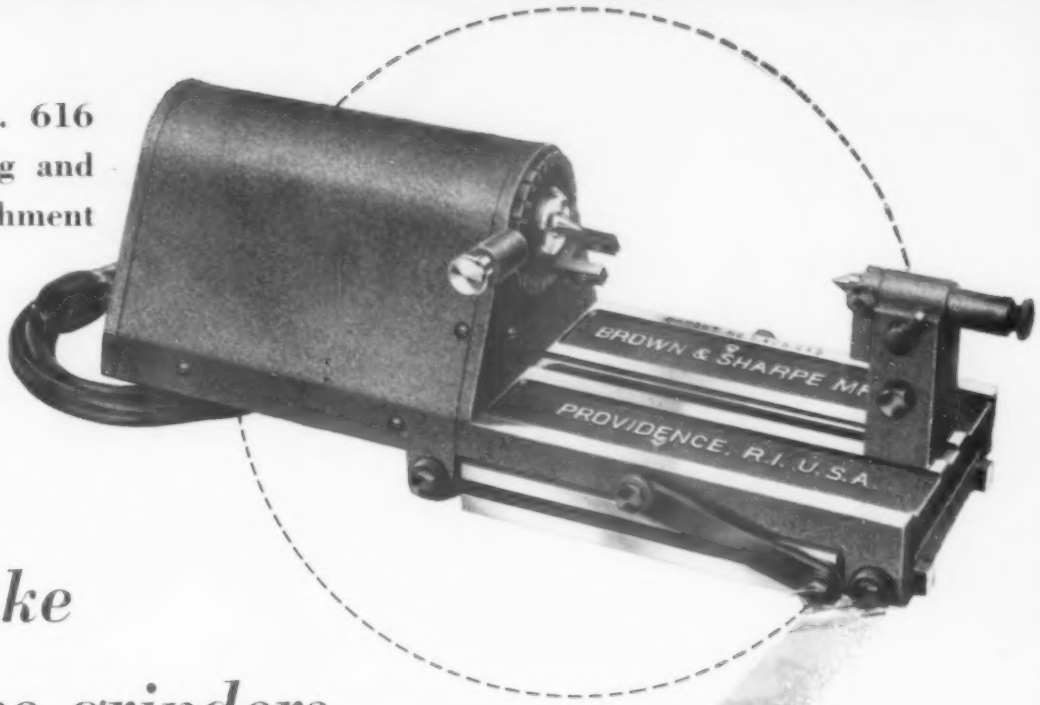
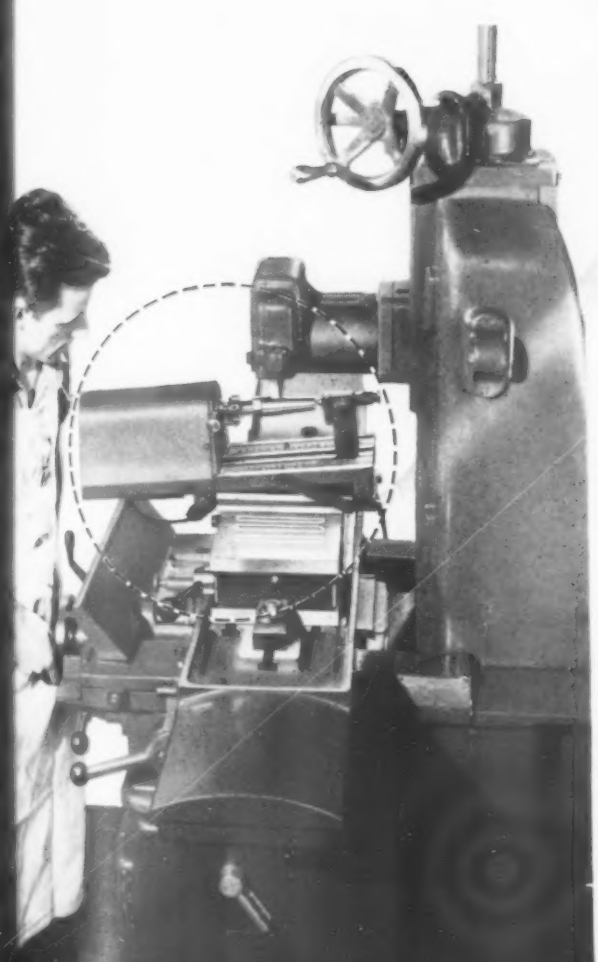
The **Versatile No. 616 Cylindrical Grinding and Indexing Attachment**



How to make your surface grinders pay EXTRA dividends...



You can use your surface grinders for dry grinding small cylindrical work, tapers and work requiring indexing, by equipping them with the Brown & Sharpe No. 616 Attachment. If you have only a limited amount of this work to do, the No. 616 can avoid the addition of another machine and a major expenditure.

On this easily portable attachment, straight cylindrical or tapered work is ground between centers, or if ½" diameter or less, work can be held in indexing spring chuck. Indexing is performed with headstock index plate or with interchangeable indexing spring chuck.

The No. 616 attachment is compact, inexpensive yet precision-built. Motor is totally enclosed. Bearings, permanently sealed. Centers are hardened both in headstock and tailstock. Get complete information on the details and advantages of No. 616 . . . write for Bulletin. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

No. 616 Attachment in use on a Brown & Sharpe No. 2L Surface Grinding Machine. Capacity of Attachment: centers swing 6" diameter; take work 5¼" in length. Maximum grinding angle, 45°.

We urge buying through the Distributor

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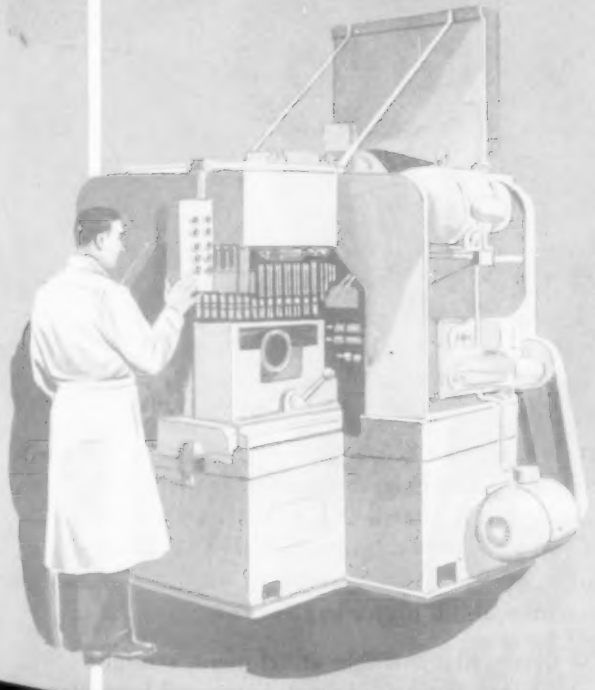
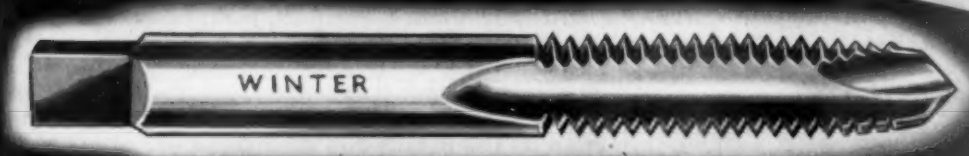
WINTER

TAPS IN ACTION



WINTER CHIP DRIVER TAPS are among the strongest taps made, and are well-suited for all classes of work except blind holes. They make a shearing cut that turns the chips ahead of the tool, permitting better lubrication of the cutting edges. This reduces the danger of clogging and breakage, and makes operation at higher speeds possible. Winter Chip Driver Taps are part of the complete Winter line of taps and dies, which also includes hand, machine screw, nut, pipe, pulley, stove bolt, and tapper taps.



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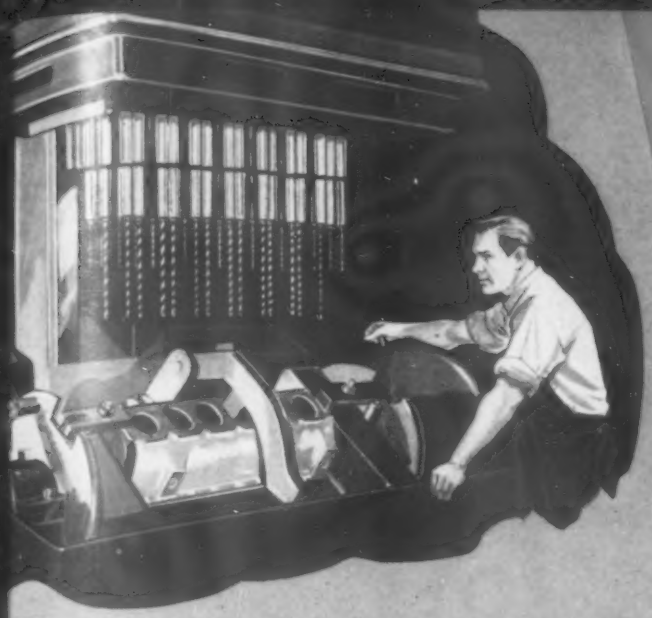

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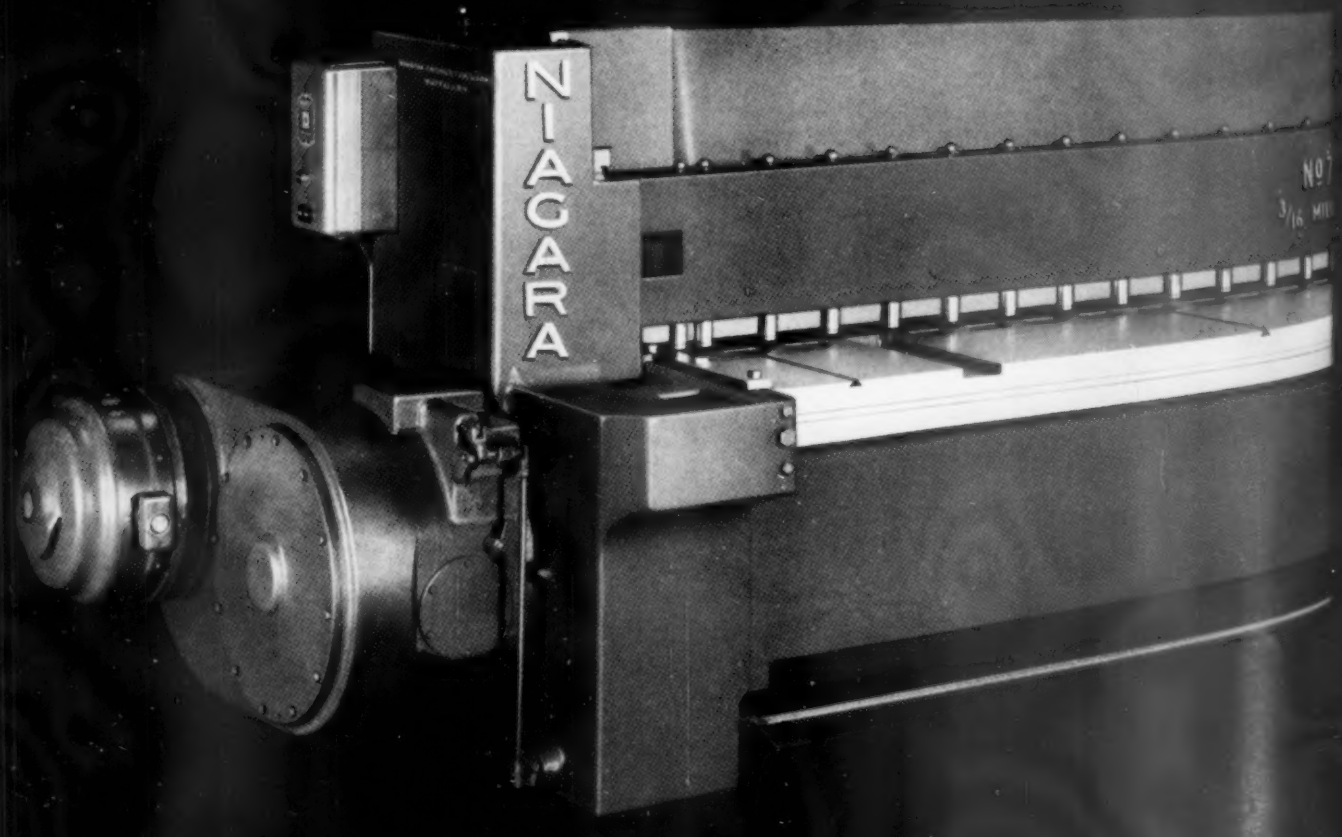

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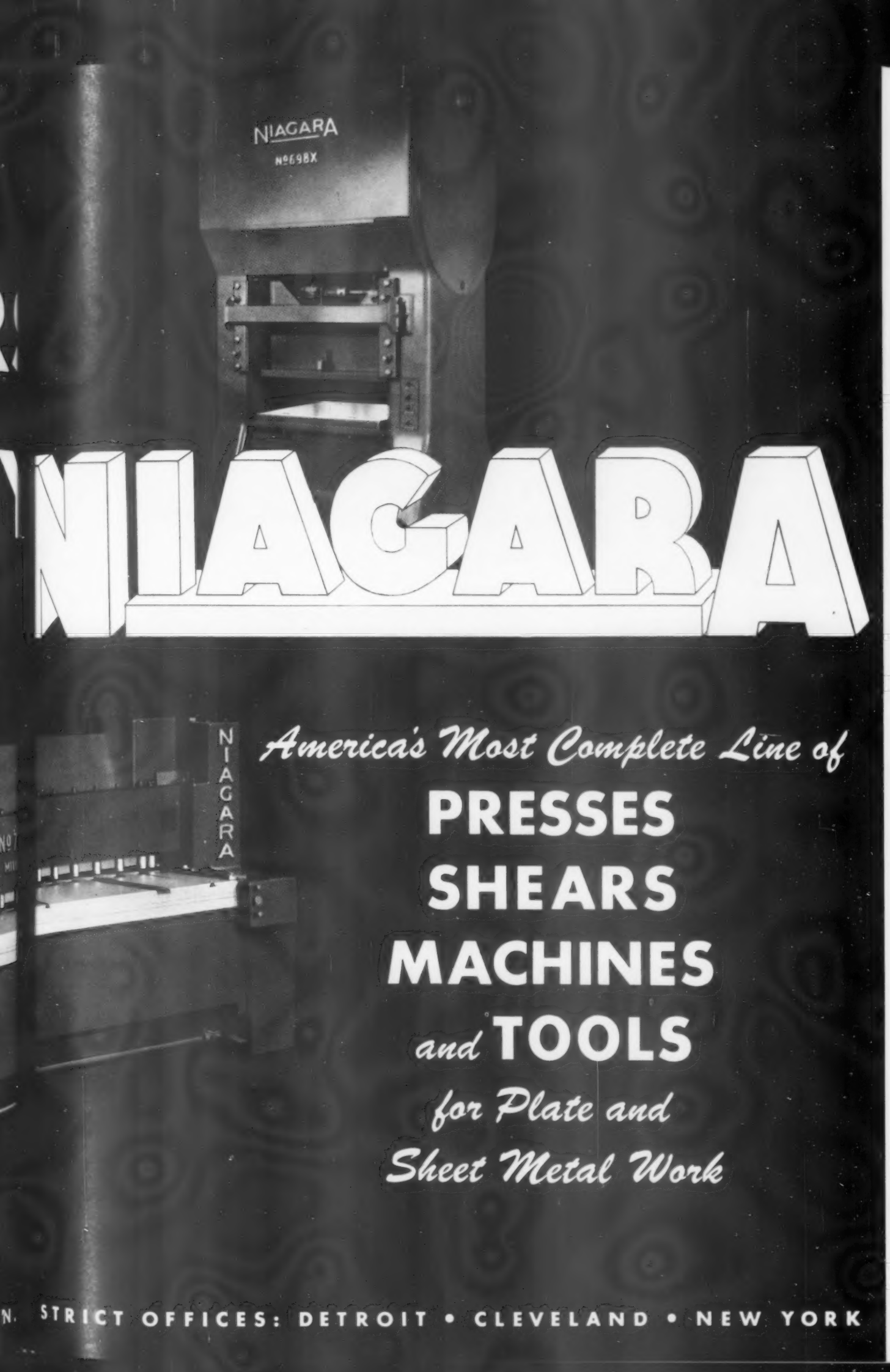

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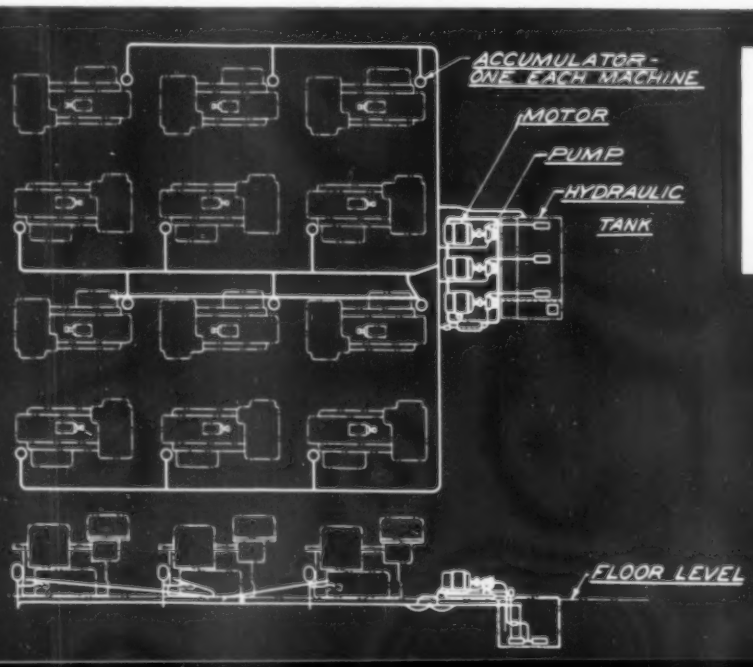
Regardless of your quantity requirements, you can depend on Heald engineering to help you increase production and reduce the cost of precision finished parts. Your nearest Heald representative is qualified to give you expert assistance on any grinding or borizing problems.



Diagrammatic sketch shows one suggested plan for battery type installation with central hydraulic system. Whether your internal grinding requirements adapt themselves to a single unit or battery type installations, Heald field engineers will be glad to study your needs and make helpful recommendations.

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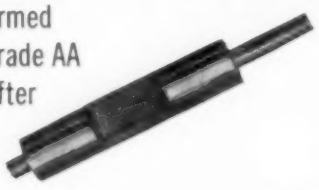
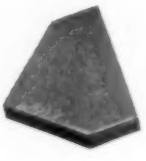
Forming electronic tube grids to extremely close tolerances on a heavy production schedule.	Specification: Preformed mandrel, ADAMAS Grade AA Delivery: 10 days after order received.		Original ADAMAS Carbide mandrels used continuously without measurable wear. Preformed mandrels required only .005 to .009 to finish on all critical dimensions.
Facing cast iron gate valve. Intermittent cut over flange holes on 20" O.D.	Specification: Style V-439 standard blank, ADAMAS Grade A. Delivery: Immediately from stock.		Increased cutting speed from 90 to 240 feet per minute. Tripled number of pieces between grinds.
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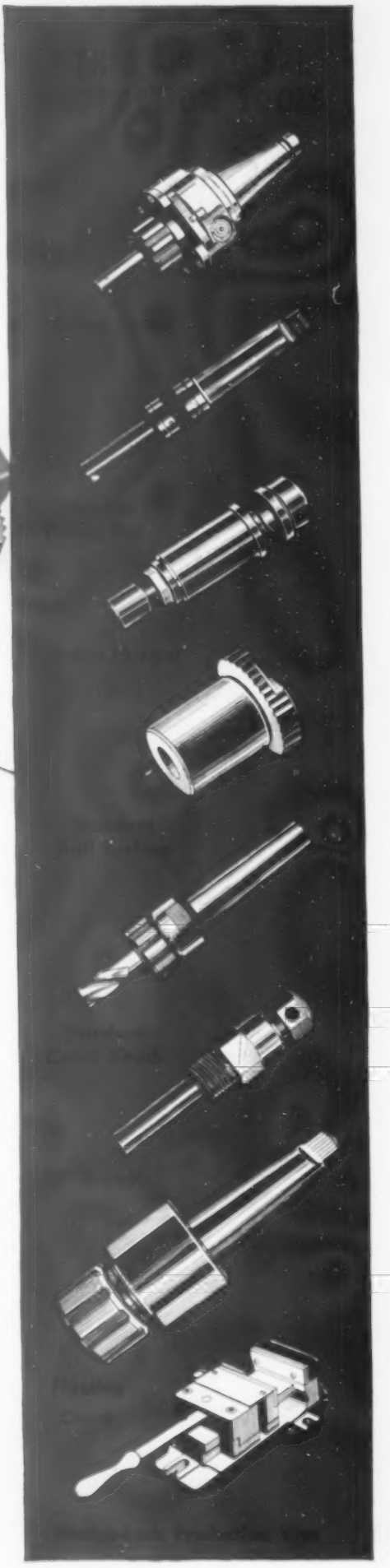

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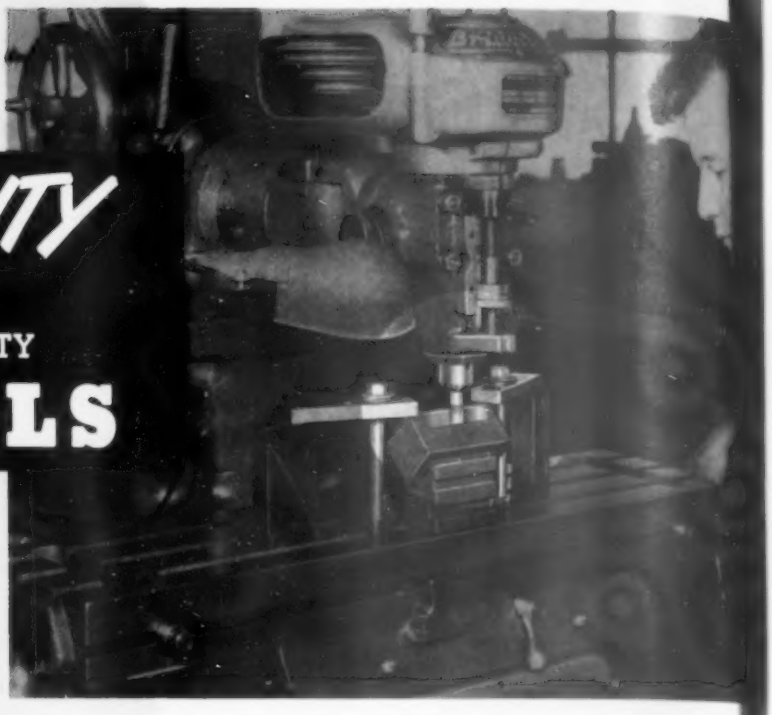
IMPROVED MACHINABILITY
IN **DIE STEELS**



Machining Cobalt Chrome Die Steel at Brooke Russell Products.

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BRAND

HIGH SPEED STEELS

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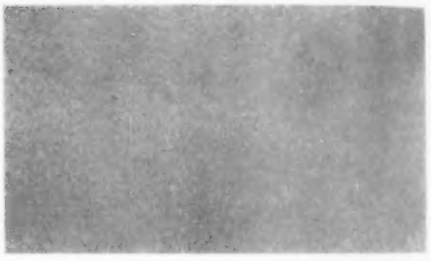
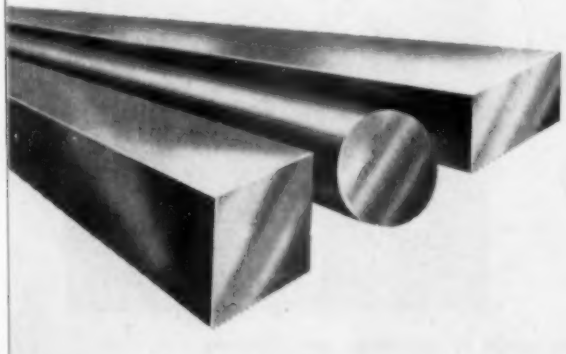


The uniform cross section of this bar of Latrobe's Desegatized Brand Cobalt Chrome Die Steel means greatly improved machinability with less damage to cutting tools while saving costly cutting time.

Large masses of hard carbide segregates seen in the center of this bar of ordinary die steel cause chattering, rapid tool dulling, and expensive machining time.

*TRADE MARK REGISTERED U. S. PAT. OFFICE



LATROBE ELECTRIC STEEL COMPANY

LATROBE, PENNSYLVANIA

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A New Concept of Surface Measurement

1—Present Methods of Surface Finish Control and Development of Geometric Surface Finish Standards

by

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IN THE PAST, the degree of surface finish applied to a finished article depended on the judgment of the machinist doing the finishing. Usually, he knew what function was to be performed by the workpiece and based the final surface finish on his experience of past performances. With small-scale production, such control is quite adequate. If the individual machinist were asked to designate his surfaces, he would probably do so by naming the method by which the surface was produced. The individual machinist could probably duplicate finishes on similar articles with a fair degree of accuracy. However the machinist has given way to the machine tool and the machine tool operator as the large producer of mass-produced items. The responsibility for designating the surface finish has shifted to the shoulders of the designer and the engineer. They, like the old-time machinist, must rely on previous experience or new experimentation for the degree of surface finish, but unlike the old timer, they have resorted to standardization, specimen sets and instrumentation as means of designating and controlling the surfaces. While the old timer was able to control his own surfaces or the surfaces produced in any one shop, he had no means of transferring the control to other shops. In addition, he had no way of correlating the surface finish of surfaces produced by dissimilar methods, and even though he attempted to control the surface by designating the method of machining, it is obvious that wide variations could occur because of dissimilar materials, physical characteristics, feeds, depths of cuts, pressures, grit sizes, bonding materials and lubricants.

The earlier methods of classifying surface finish divided all surfaces into such broad groups as rough, medium and fine, or coarse, commercial and smooth. Further refinement of terminology brought into being the use of symbols such as f1, f2, and so forth. These specifications were naturally associated with the method of producing the surface. The original and most basic method of specifying a surface was to refer to a specimen surface. As early as the 1920's, the Norton Company produced sets of ground specimens similar to the type shown in Fig. 1 for their own use and for distribution to others. General Electric also developed a set for their own use. Today, there are many specimen sets commercially available whose specimens are samples of machined or ground or otherwise natural machined finishes. The use of these specimens has greatly clarified the problem of controlling surface finishes, especially since they have been correlated with the recently adopted American Standards Association B46.1 Standard on Surface Finish. In general, machined surface specimen sets are inexpensive, and easy to use. Because their use requires little or no training, they may be used directly by the machine operator or machinist, thus easing the load on the inspection room. The machined specimen sets have the added advantage of demonstrating the character of surfaces and giving the equivalent roughness for different types of character where more than one machine method has been used in any one of the roughness classifications. This is valuable information for draftsman and designer, because often where there are no previous performance figures to support proper selection of functional surfaces, a study of the character of surfaces suggests the type of surface that should be used. Specimen sets are meant for visual and or tactual comparison with the work piece. Experienced machinists can compare unknown surfaces with calibrated specimens within 20 percent accuracy, but this is generally true only when the materials and the method of machining are identical. Machined specimens are not sufficiently accurate for instrument calibration because of the non-uniformity of the roughness at different locations on any one surface. In addition, it is unwise to extrapolate roughness values when comparing the machined specimens with unknowns that have a different character due to difference in materials, or exact methods of finishing. Although luster and color and reflectivity are not criteria for judging the roughness of a surface, dissimilarity in these characteristics leads to faulty analyses.

At present, the most widely used method of absolute surface finish comparison is the stylus-type instrument. In fact, it was not until after the instrument makers developed the direct reading roughness measuring instrument that any attempt was made to standardize the terms and methods of designating surface roughness. The use of the stylus-type instrument made possible the designation of surface roughness as a linear measurement of the depth of the roughness. When well calibrated, the instruments are capable of extremely accurate measurement. It is the instru-

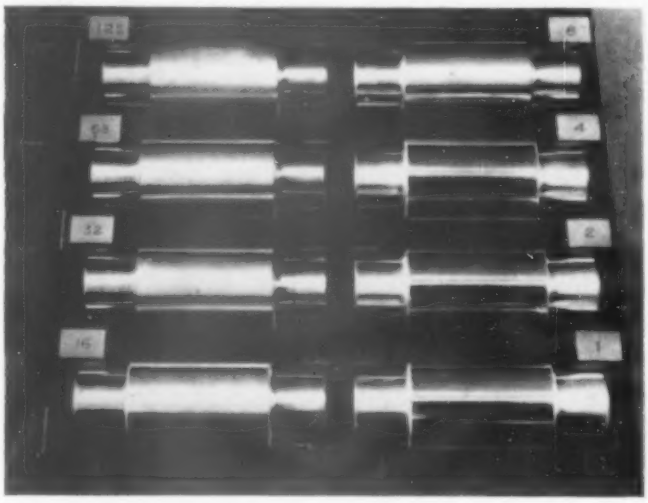
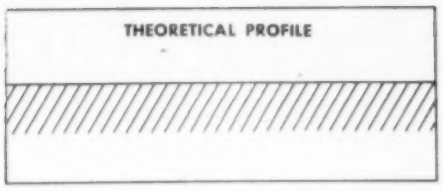
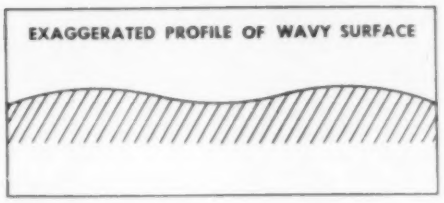
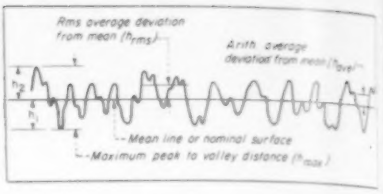


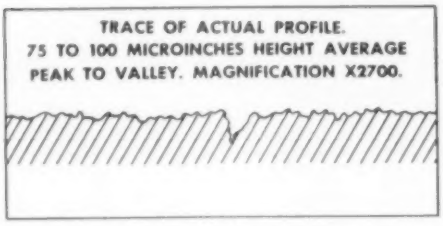
Fig. 1. This set of ground specimens was produced by the Norton Company for their own use over 20 years ago.

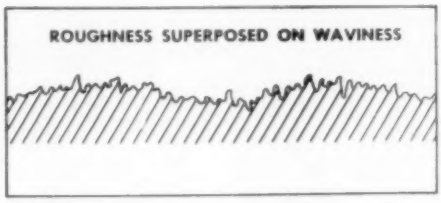
Paper presented before Seventeenth Semi-Annual meeting, ASTE, Montreal; October 27.






Rms average deviation from mean (h_{rms})
Arith. average deviation from mean (h_{ave})
Mean line or nominal surface
Maximum peak to valley distance (h_{max})





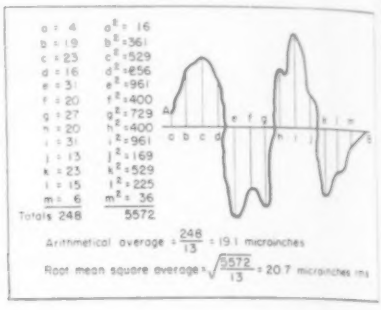


Fig. 2 (top); Fig. 3 (bottom) Fig. 4 (top); Fig. 5 (bottom)

Fig. 6 (top right) illustrates the relationship among the four ASA ratings for surface roughness.
Fig. 7 (bottom right) compares the arithmetic and root mean square ratings.

ments that have indicated the variations that normally occur on ordinarily machined surfaces. The use of the instrument eliminates some of the dependence of the roughness readings on the personal interpretation of the inspector when compared to the use of the specimen sets, but there still remains some variation in results due to slightly different techniques and interpretations. In addition to identifying the degree of roughness by a number, certain presentday instruments are capable of producing a graph of the profile of the roughness and the contours of the waviness encountered. Knowledge of these two characteristics is sometimes invaluable in studies of the behavior of surfaces. The stylus-type instruments can give erroneous results. Poor calibration of the instrument is one source of incorrect answers and a worn stylus or the presence of dirt on the surface or on the instrument head are others. In addition, the stylus-type instruments are accurate only over a limited range of roughness scratch frequencies.

For accurate measurement of roughness of fine surfaces and overall waviness of surfaces of suitable reflectivity, the interferometer and microinterferometer are being developed. These instruments operate on the same principle as the optical flat. Their only disadvantage is they are limited to fine roughness values only. Calibration difficulties are nil because the observations are based on the invariable wave length of a monochromatic light.

There are numerous other surface comparators, but these do not supply quantitative answers. As the name comparator implies, their main function is to compare unknown surfaces with known surfaces that have been produced by similar machining methods. These methods might be said to be visual aids. In this category fall the comparison microscope, the air gage, the reflection-type meter, and plastic replicas.

It would be well before going further to enlarge on the present degree of standardization of surface finish terminology and designation. As has been indicated, standardization was not attempted before adequate means of measuring surfaces had been made. After numerous meetings and preliminary publications, the present American Standards Association B46.1 Standard on Surface Roughness, Waviness, and Lay was adopted in February, 1947. The Society of Automotive Engineers' Standard on Surface Finish, which is patterned largely on the ASA B46.1 Standard, was adopted in March, 1949. Both standards are now published and active. The standards do not define the means by which a surface is to be produced nor by what methods the surfaces shall be measured. Further, the standards are not concerned with the physical or optical characteristics of the surfaces. The standards are concerned only with the geometrical irregularities of the surface and their direction.

Following are the definitions listed by the standards:

SURFACE. The surface of an object is the boundary which separates that object from another substance. Its shape and extent are usually defined by a drawing or descriptive specification.

PROFILE. The contour of any specified section through a surface. Fig. 2 illustrates the theoretical profile envisioned by the designer.

ROUGHNESS. Relatively fine-spaced surface irregularities. On surfaces produced by machining and abrasive operations, the irregularities produced by the cutting action of tool edges and abrasive grains, and by the feed of the machine tool are roughness. Roughness may be considered as being superposed on a "wavy" surface. Fig. 3 illustrates the departure of the nominal profile from the theoretical profile because of roughness.

WAVINESS. The surface irregularities which are of greater spacing than the roughness. On machined surfaces such irregularities may result from machine or work deflections, vibrations, etc. Irregularities of similar geometry may occur due to warping, strains, or other causes. Fig. 4 illustrates theoretical waviness while Fig. 5 illustrates how roughness can be superimposed on waviness.

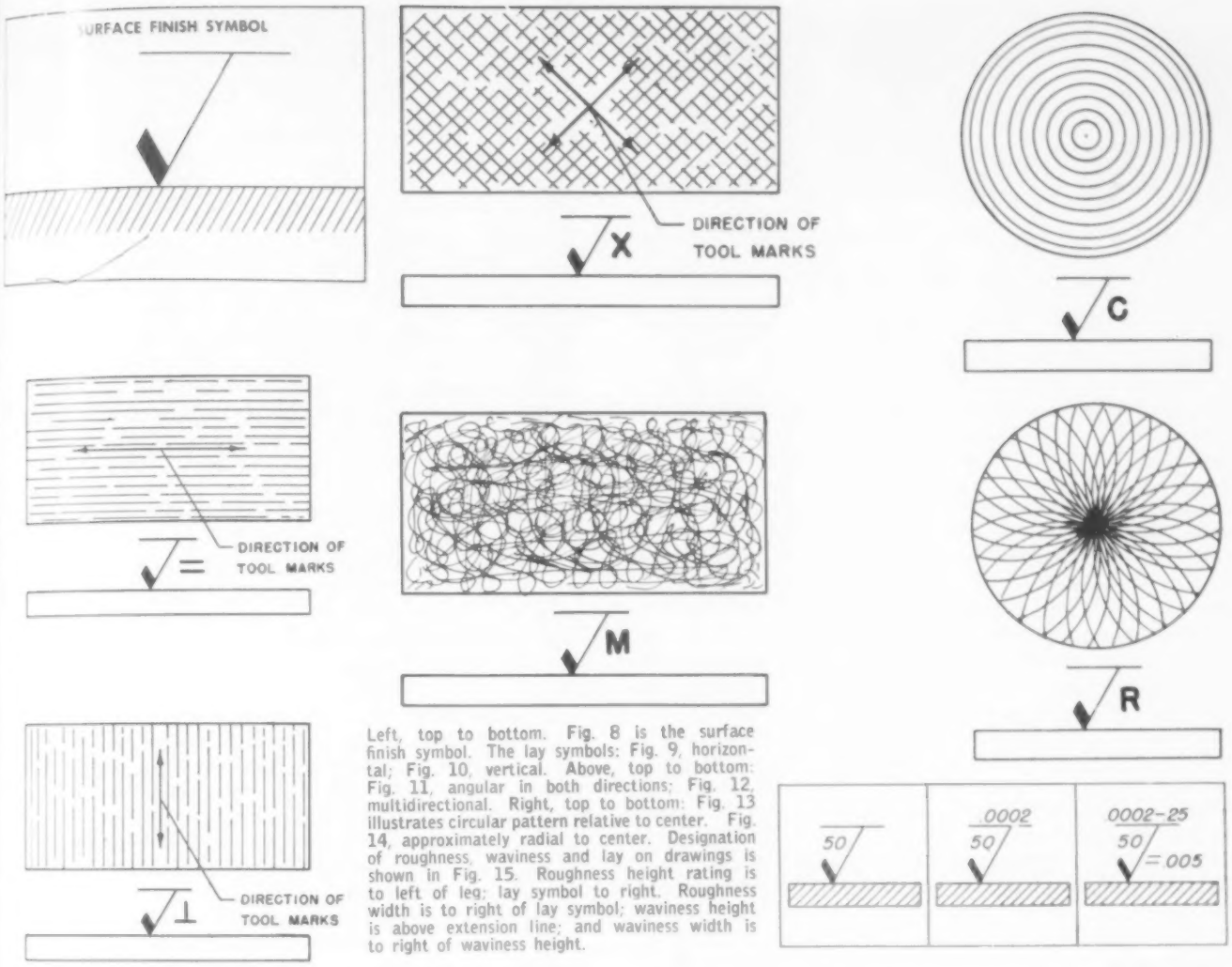
FLAWS. Irregularities which occur at one place, or at relatively infrequent intervals in the surface, such as a scratch, ridge, hole, peak, crack, or check.

LAY. The direction of the predominant surface pattern.

The ASA standard allows four different methods of rating surface roughness:

Maximum peak to valley height
Average peak to valley height
Root mean square of deviations from the mean suface
Arithmetical average of deviations from the mean surface

Fig. 6 illustrates the relationship between these ratings. The ASA standard was purposely broad to allow for the varied opinions of the different factions involved. However, the use of a multiplicity of ratings of roughness leads to confusion. Consequently, the SAE Standard on Surface Finish rates roughness as arithmetical average deviation from the mean surface only. Because of the indefinite concept of what constitutes a peak and what constitutes a valley, deviation from the mean surface was chosen. Since it integrates highs, lows and intermediate values of roughness, it provides a figure that is more of an overall gage of the surface than the peak to valley measurements. Averaging-type instruments usually read some function of the deviation from the mean surface. The reasons for choosing the arithmetical average rather than the root mean square were two. It is believed that the arithmetical average is more easily understood by the personnel required to measure and produce surfaces. In addition, the arithmetical average eliminates square and



Left, top to bottom. Fig. 8 is the surface finish symbol. The lay symbols: Fig. 9, horizontal; Fig. 10, vertical. Above, top to bottom: Fig. 11, angular in both directions; Fig. 12, multidirectional. Right, top to bottom: Fig. 13 illustrates circular pattern relative to center. Fig. 14, approximately radial to center. Designation of roughness, waviness and lay on drawings is shown in Fig. 15. Roughness height rating is to left of leg; lay symbol to right. Roughness width is to right of lay symbol; waviness height is above extension line; and waviness width is to right of waviness height.

square roots, thereby making the use of a wider range of instruments possible. Fig. 7 illustrates the relationship between the arithmetic and root mean square ratings. At present gage readings of most stylus-type instrumentation rate roughness in RMS values, but these instruments can be adjusted to read the arithmetical average with very little effort. Indeed, the difference between the RMS and the arithmetical average is generally a factor of only about 10 percent, with the RMS the larger of the two readings. Since the variations usually occurring in naturally machined surfaces far exceed 10 percent of the nominal roughness, the adoption of the arithmetical average by present users of the RMS rating should not occasion a wholesale correction of drawing specifications.

The roughness width, waviness width, and waviness height are all expressed in inches, or decimal portions thereof.

The ASA standard allows measurement of roughness values by comparison with reference surfaces, or by direct instrument measurements. Comparison can be made by sight, feel or instrument. The SAE standard recommends that all roughness measurement be based on a set of standard surfaces, the values of which are the same from set to set. Instruments may be used for direct measurement if they have been calibrated against the standard surfaces; visual or tactual comparisons are best made by employing pilot specimens of the surface to be measured. Both standards warn that care should be exercised when using instruments that the specified character or quality of the surface is measured. Both standards include recommended roughness height and waviness height values. These values should be used for specifications to the exclusion of other values so that comparison with specimen sets is positive. The values are so chosen that they adequately cover the field of possibilities and are of close enough spacing to fall within the ordinary range of allowable variation usually encountered when measuring a surface.

Fig. 8 is the surface finish symbol by which finish specifications may be indicated on drawings. The symbol may be on the line indicating the surface, on a witness line or on a leader pointing to the surface.

The lay symbols are illustrated in Figs. 9 to 14. The figures show the use of the lay symbol for each type of surface in conjunction with the surface finish symbol. The symbol appears on the profile of a surface, the hypothetical plan view of which appears immediately above it. Fig. 9 illustrates parallel lay; Fig. 10, perpendicular; Fig. 11, angular in both directions; Fig. 12, multidirectional; Fig. 13, approximately circular relative to the center; and Fig. 14, approximately radial relative to the center. For most applications, these lay symbols take the place of specific notes or symbols designating the method of machining. This allows more flexibility in the procesisng shop, and, when coupled with the roughness height and width ratings, is a great deal more exact in obtaining the desired surface.

The method of designating the roughness, waviness, and lay on drawings is shown in Fig. 15. The roughness height rating is to the left of the long leg, the lay symbol to the right. The roughness width is to the right of the lay symbol. The waviness height is above the extension line and the waviness width is to the right of the waviness height.

Increasing confidence is being shown by both the engineer and the production man in the specification and the production of controlled surface finishes. However, there is still the question of what is the physical depth of a microinch of

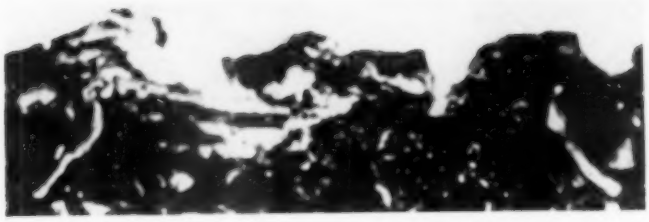


Fig. 16. The inconsistency of a naturally machined finish for use as a surface finish standard is shown in this micrograph.

roughness. In other words, there is no physical standard, no yardstick by which we can measure roughness whether in Maine or California and be sure that the results are comparable. The research and development groups of General Motors and Chrysler have set out to develop a physical standard. Naturally machined surfaces were at first considered, but it was believed that because of their inherent variability, they could not be used as standards. Fig. 16 shows the inconsistency of a naturally machined surface. It was eventually decided that an artificially prepared surface would best serve the purpose of defining surface roughness. This surface was to have the roughness ruled on and there were to be sufficient of these ruled surfaces to cover the full range of recommended roughness values. The surfaces were to be many more times accurate and consistent than the naturally machined surfaces, and in actual fact they are. It was believed that such surfaces could be used to calibrate instruments and could also be used as tactual and visual comparators. This last application has since been discarded, because of the purely synthetic appearance and feel of the surfaces. The ruled surfaces have been designated as Geometric Surface Finish Standards and are to be the basis of the Surface Finish Standards of both Chrysler and General Motors. On completion of the set, the Geometric Standards will be offered for adoption to both the SAE and the ASA.

It was hoped that the specimens could be made on one of the diffraction grating machines in operation at one of the universities or companies in the United States, but none seemed available for sufficient time to complete the development of a set of specimens. Therefore, the General Motors Research Laboratories designed and built a ruling machine for the express purpose of ruling the Geometric Standards. The machine is shown in Fig. 17. The machine is essentially a small planer. For freedom from friction, the table is oil-floated on the ways by a hydrostatic oil film supplied from an externally placed pump. The workpiece is placed on the table of the machine and the lines are ruled by dragging a diamond of specified angle across the surface. The diamond is mounted on a pivoted arm which is raised and lowered by a cam actuated by the reciprocation of the table. The depth of the cut is regulated by weights placed on the pivoted arm.

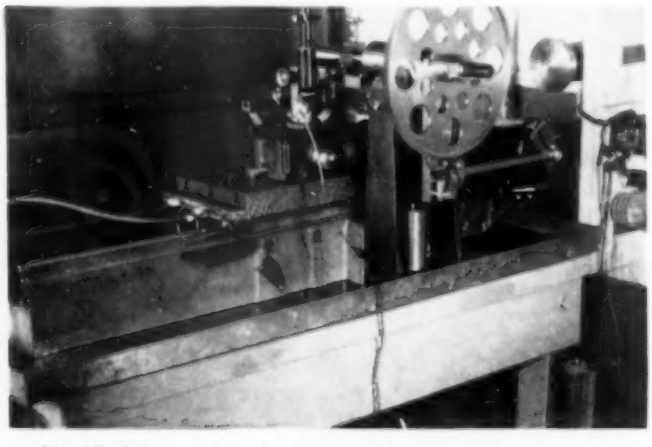


Fig. 17. Ruling machine developed by GM research labs for ruling the Geometric Standards.

The diamond is indexed across the surface during each backstroke by the engagement of a solenoid-actuated pawl with a 500 tooth rachet which is fixed to the 20 thread-to-the-inch lead screw. Both the lead screw and the rachet are accurately ground. The lead screw advances the sliding nut on which the pivoted arm is mounted. Reciprocation of the table and the indexing pawl are controlled by adjustable cranks on the final gear reduction shaft. The indexing pawl solenoid is actuated by the depression of a microswitch by a semicircular cam of the indexing crank. The whole mechanism is driven by a 1/70 hp dc motor with total gear reduction of 720 to 1. Speed regulation is obtained by a variable resistance in series with the field of the drive motor. Backlash of the sliding nut is controlled by a 5 pound weight wired to the nut and hanging freely, while the backlash of the lead screw is controlled by a simple bakelite-duck brake on the lead screw shaft. The periodic error of the machine, attributable mainly to the lead screw thrust bearing, is plus or minus 2.22 percent for one turn of the lead screw.

The angle of 150 deg was chosen for the basic angle of the grooves, in order to allow deep penetration by stylus-type instruments as shown in Fig. 18. The spacing of the rulings is held between 0.008 and 0.0002 inches. With the above limitations, using the variety of ruling pitches available from the ruling machine, surfaces having roughness values from 1000 microinches down to 25 microinches can be ruled by the 150 deg diamond. The problem of reproduction of the ruled specimens was solved by the U.S. Rubber Company Electroforming Division. Using their Ekko plating process, the U.S. Rubber Company technicians were able to reproduce rulings accurately through the sixth generation of replicas. The choice of metals on which to rule was controlled largely by the recommendation of the Electro-forming experts, so that gold was chosen. Gold is stain-and tarnish-resistant and can be cleaned chemically without damage to the surface. In addition, it is soft enough to flow evenly away from the tool as it is ruled, thereby eliminating chipping of the metal. This last characteristic also proved of value in forming the peaks between the rulings. It was believed also that gold had little or no work-hardening characteristics. This however, did not prove to be true.

The specimens on which the rulings are made are 2 inch by 3 inch blocks of silver-clad steel, shown in Fig. 19, on which has been plated 0.005 inches of gold. Build-up on the edges of the gold surface is somewhat alleviated by the use

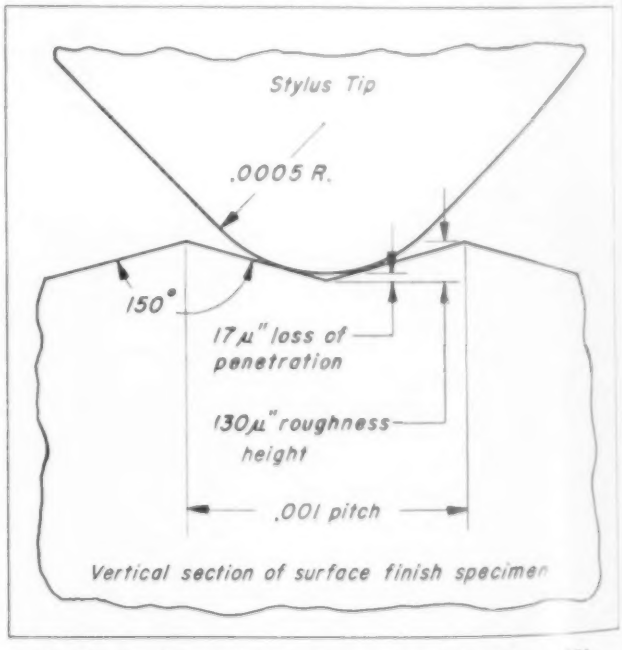


Fig. 18. In order to allow deep penetration of the stylus, a 150-deg angle was chosen for the basic angle of the grooves.

Fig. 19 illustrates the silver-clad steel block, plated with 0.005 in. of gold, on which the rulings were made.

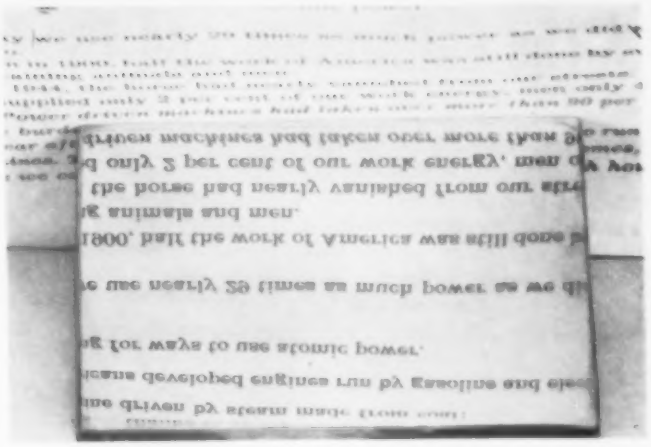


Fig. 20. Finish of the polished blocks before ruling is well illustrated in the photo above.

of a plastic mask, and flaws and graining are held to a minimum by alternately plating and deplating the surface. The plated surfaces are polished on fine emery paper on a lapping plate and then polished with sapphire abrasive on a linen-covered plate glass polishing wheel. The final polished surface is mirror smooth, as shown in Fig. 20, having a roughness of about one microinch average. Extreme care must be exercised in polishing the gold to prevent inclusions and smearing of the metal. Attention must be given to the quantity of lubricant, amount of removed metal on the wheel, pressure on the surface, and contamination of the wheel by foreign particles. Contrary to logical reasoning, gold does not polish too readily, especially when a large area is involved. The polishing abrasive tends to slice through the gold rather than to remove it.

The ruling machine was calibrated to determine the relationship between the weight on the diamond tool and the depth of the cut. Subsequent operations, however, have proved that the penetration of the diamond during ruling is subject to other variables beside the weight on the diamond. It is suggested that variable thickness of the gold plate could be partially responsible for erratic results or varying amounts of work hardening of the polished gold.

The specimens are ruled with three patches as shown in Fig. 21, and are then reproduced by the electroforming method. The second generation reproductions are calibrated by taper sectioning as described by Dr. Lewis. If the replicas prove to be within 5 percent of the nominal value, and if the rulings are consistent and without flaws, the patch is acceptable for further reproduction. Additional second generation replicas are obtained and the proper specimens are mounted by groups of threes in fixtures for production plating. Fig. 22 is a view of a reproduction taken from one of the assembly fixtures. The plating operation is carried on to the sixth generation, and the total number of replicas by this time is sufficient to meet the demand of the purchasers. Spot checks are made on the final generation replicas at regular intervals to assure uniformity of the specimens. This reproduction of all the replicas from one master fixture automatically insures that every user of the specimens will be employing the exact duplicate of every other set. With a large distribution of the geometric standards the uniformity of surface finish control should improve manyfold over present controls.

The Geometric Surface Finish Standards are to be merchandized through the electroplating firm of F. A. Ringler and Company, successors to the U. S. Rubber Company Electroforming Division. The cost of the specimens will include only the expenses of reproduction. Both General Motors and Chrysler feel that their expenses should not be included in the price of the specimens, because, in their opinions, they will be amply repaid by the increase in the quality of suppliers' products through the use of the specimens.

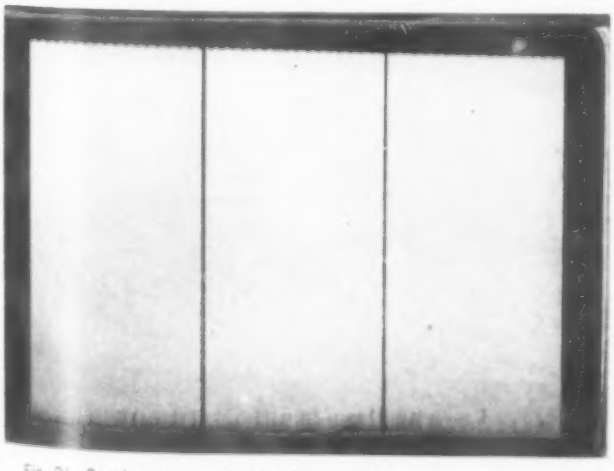


Fig. 21. Specimens are ruled in three patches as shown above, and are then reproduced by the electroforming method.

Fig. 22 is a reproduction taken from one of the assembly fixtures

2-The Calibration and Use of Master Roughness Standards

By C. R. Lewis
CHRYSLER CORPORATION

THE PREVIOUS PAPER HAS discussed the manufacture of a set of precision physical standards of surface roughness. To take full advantage of the accuracy and uniformity to which these standards are made, a precise measurement of the size and shape of the surface irregularities is needed. Such a calibration presents considerable difficulty, since the total profile height of the finest surface which has been made is almost exactly one wave length of green light. Optical methods cannot be applied directly for the measurement of such small distances. Mechanical methods of measuring deflections of a few millionths of an inch are difficult and not reliable.

Fortunately, a technique which can be applied to this problem has been developed. Some years ago Nelson[1] proposed a system of taper sectioning for the examination of surface irregularities which effectively increases the magnification in one direction by a factor as much as 25 to 1. Fig. 1 shows the basis of this technique. If a surface of a sample making a small angle with the original surface is prepared for observation, surface asperities perpendicular to the line joining the two surfaces are increased in apparent height by a factor depending on the angle of taper between the original and the new surface. For a taper magnification of 25 this angle is approximately 2 deg 17 min.

In preparing a sample for examination by this method, the original surface is covered to a depth of a few thousandths of an inch with a metal of hardness as close to that of the base material as possible. This extra coating is necessary to protect the original surface during subsequent processing. The coated sample is then placed on a jig which has previously been machined to the correct taper angle, and the whole assembly ground by a surface grinder until the interface between the original sample and the surface coating lies approximately in the middle of the sample. The tapered surface is then given a conventional metallographic polish as shown in Fig. 2. When looking at taper

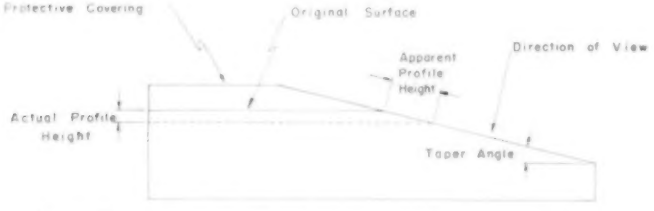


Fig. 1. The Nelson technique of taper sectioning for examination of surface irregularities.

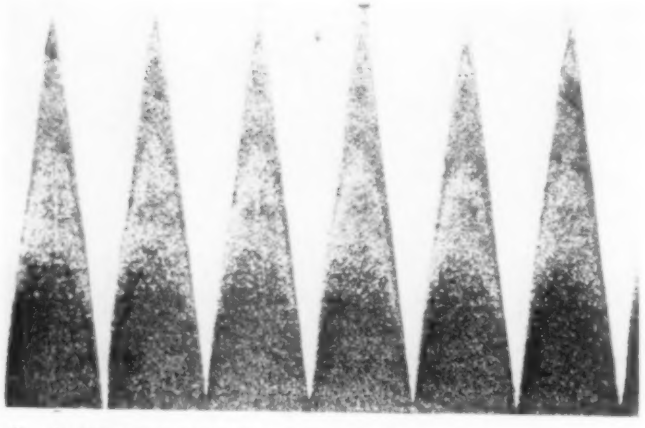


Fig. 2. Micrograph of polished surface specimen.

section photographs, it should always be remembered that they do not reproduce the true appearance of the surface profile, since the vertical magnification is about 25 times that of the horizontal. The grooves seen in Fig. 2, for instance, should be 150 deg instead of the apparent 15 deg. The distortion inherent in the taper section method is more clearly shown by reference to Fig. 3, which is a normal section of one of the geometric standard surfaces.

A series of taper sections of normal machined surfaces has been made which are of considerable interest in connection with the geometric surface standards. These taper sections (Figs. 5-12) illustrate both the variety and non-uniformity of surface profiles obtained from common machining operations.

It has been explained above that the taper angle determines the magnification given by the taper section. Thus, in order to make measurements on taper sectioned surfaces, the taper angle must be known precisely. Although the original grinding on the sample is accurate to a few seconds of arc, the subsequent metallographic polishing procedures tend to alter this angle slightly. This fact was a serious obstacle to the calibration of these surfaces until it was realized that the angle at the point of the diamond which produces the grooves provides a groove angle which is constant as well as accurately known. Consequently, a measurement of the apparent groove angle of the tapered surfaces can be used to determine the angle of taper. The necessary geometrical relationships for this computation are shown in Fig. 4.

To date it has not been found possible to calibrate the ruling machine to a sufficient accuracy to predict the exact height of surface irregularities produced on a given sample. Consequently, each sample when ruled is made to contain three separate ruled surfaces of slightly varying depth. These samples when completed are put through the same duplicating process which will be used for production sets. One replica is used for the height calibration. When duplicating has been completed, this replica is given a preliminary measurement on a surface analyzer to determine its

[1] Taper Sectioning as a Means of Describing the Surface Contour of Metals, by H. R. Nelson. Proceedings of the Special Summer Conferences on Friction and Surface Finish, M.I.T., Cambridge, Mass., June 5, 6, and 7, 1940.

Fig. 3. This micrograph, compared with Fig. 2, illustrates the distortion inherent in the taper section method.

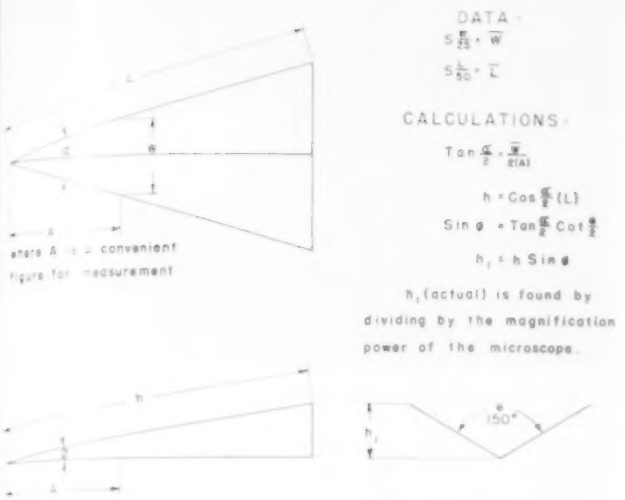


Fig. 4. Determination of the angle of taper, using the known groove angle.

uniformity, and a careful visual inspection to check for any flaws. If it passes these tests, the surface is electroplated with 5 to 10 thousandths of an inch of nickel. The sample, which measures approximately 2 x 3 inches, is carefully marked for identification and divided into nine parts, so that there are three samples of each surface.

Each of the smaller samples is placed, in turn, on a research model metallographic microscope. The magnification is adjusted to a convenient value such that the sample profile has an apparent height on the microscope screen of from three to five inches. The microscope stage is set at one end of the sample and measurements of L_1, L_2, and W (see Fig. 4) are made with an accurate scale[2]. These measurements are repeated for twenty-five lines in the sample surface. The microscopic stage is moved after each second set of measurements, so that the twenty-fifth measurement is made at or near the center of the sample. The sample is then re-set on the stage and the process is repeated, starting at the other edge. This method calls for the making of 150 individual measurements on each sample, or a total of 1350 measurements for each sample surface approved as a master for production sets.

In making the calculations the two sets of measurements of twenty-five individual lines are treated separately. In this way average profile heights are obtained for both sides of the sample and at three approximately equally spaced longitudinal positions on the ruled surface. If these individual determinations differ appreciably the surface is rejected.

It should be noted that the calibration of these standard

[2] L_1 and L_2 are values measured on a given groove and averaged to produce L as in Fig. 4—Ed.

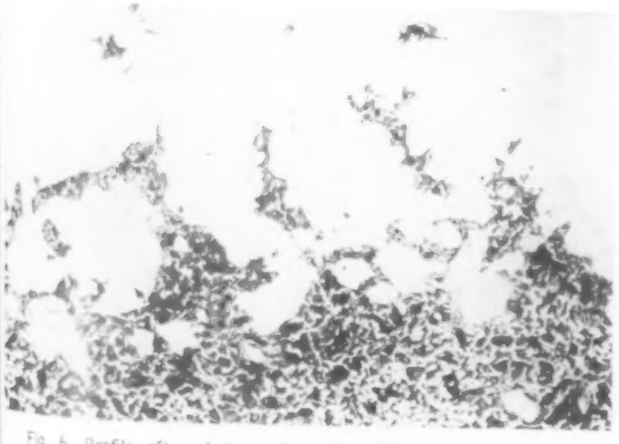


Fig. 6. Profile after shot peening. Mag 100x

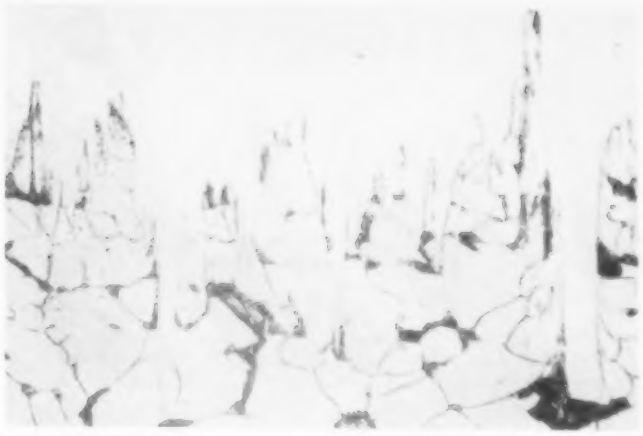


Fig. 5. Profile after milling operation. Mag 700x

surfaces is not done directly on the original ruled master surfaces but rather on replicas. It was originally planned to carry out all calibration on sixth-generation replicas similar in all respects to those which will be available for distribution. This involved the expenditure of several months for each sample to carry out the necessary electroplating operations. After a number of the standard surfaces had been calibrated, it was found that no significant or systematic differences could be found between the second and sixth-generation replicas. Therefore the calibrating work is now being down on second-generation replicas.

After a particular surface block sample has been measured and found to have the correct depth plus the necessary uniformity of individual rulings, the second-generation replica is removed from storage, and the appropriate one of the three individual surfaces is removed and machined. Three such surfaces are then assembled in a jig as previously explained, and the unit serves as a master surface for the production of the geometric surface standards.

During the past 20 years a considerable number of individual manufacturing companies have made sets of machined surfaces for use as surface finish standards. However, they have all suffered from a number of serious disadvantages, since it is highly difficult to judge by appearance the comparative roughness of two surfaces differing from each other appreciably in either shape or material. To the eye, roughness influences only the way in which the surface reflects light. Therefore alterations in the large-scale geometry of the surface, and changes due to the varying reflectivity of different materials, may be judged to be changes in surface finish, and precise visual comparisons between such differing surfaces are extremely difficult to make. In making a set of surface finish specimens it is possible in only a few cases to have a sufficient number

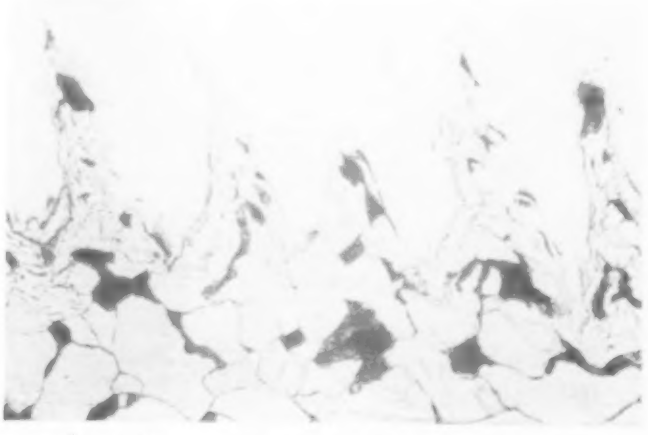


Fig. 7. Profile after fine turning operation. Mag 500x

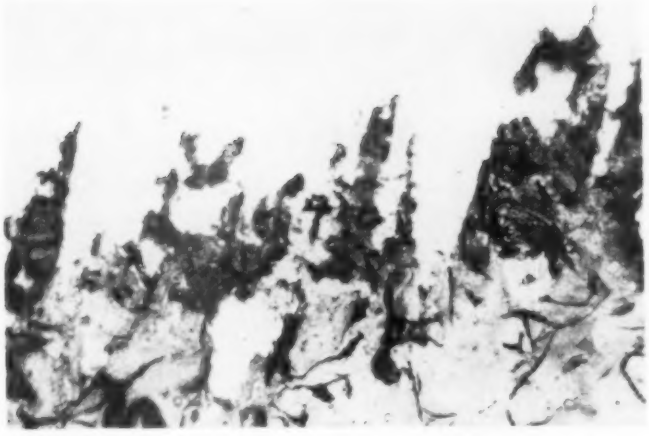


Fig. 8. Profile of specimen after shaving. Mag 250x

of specimens to make comparisons with all the surfaces being produced. For this reason, most of the machined surface finish comparison sets have been found inefficient when they are used for precise control of surfaces.

If attempts are made to use such a set of machined surfaces for instrument comparison, a further trouble develops. These machined surfaces cannot be made to extremely close tolerances. A set of specifications proposed by the ASA for such a set of comparison surfaces calls for tolerances in average roughness of the whole surface ranging from 10 to 30 percent. Individual measurements on a particular spot will vary even more widely on most machined surfaces.

The use of the geometric surface standards is expected to overcome these difficulties. Although actual shop experience is needed before they can be utilized most efficiently, it appears that the use will fall primarily into two categories. Since they are about one order of magnitude more accurate than present standards, they should serve as reference standards for surface finish measuring instruments, in much the same way that gage blocks are used for the calibration of length-measuring instruments. By using them as instrument calibrators, no question need arise as to the equivalence of measurements taken at widely differing places or times. When checked regularly with the geometric standard surfaces, instruments now in use will readily show any departure from calibration. The seriousness of this problem is emphasized by experiments of the Army Ordnance Gage Laboratory which show deviations as high as 60 to 70 percent by different instruments on a given surface.

The availability of the geometric standard surfaces will encourage the design and production of new instruments relying on the standard surfaces completely for their calibration. One of the larger manufacturers of measuring

Fig. 9. Specimen grit blasted, ground and lapped. Mag 300x

Fig. 10. Profile of specimen after honing. Mag 700x

instruments is negotiating for the use of these surfaces for calibration, and has indicated that such use will reduce the initial cost of the instrument by nearly one-half. A gage company is engaged in the development of a surface roughness measuring instrument utilizing a principle not previously applied in this field, and is similarly depending on the geometric standard surfaces for calibration.

The second main use of the geometric surface finish standards is expected to be in the preparation of shop standards. With the geometric surface standards available, there will be no difficulty in preparing shop samples to engineering specifications, and insuring that the samples are uniform both in different locations and at different times. If a large-scale production process is being controlled, a shop sample can be duplicated by the methods used to prepare the geometric standards, and the replicas distributed as widely as may be desired. Such work-piece standards will be relatively inexpensive, and will enable direct comparison to be made between a surface being produced and a specified surface.

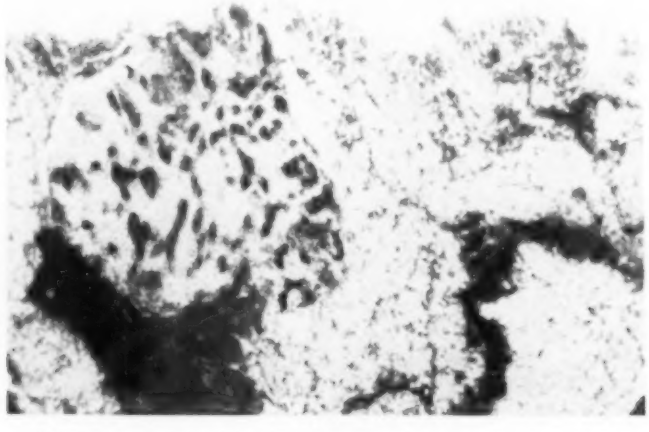


Fig. 11. Sprayed metal surface. Mag 250x

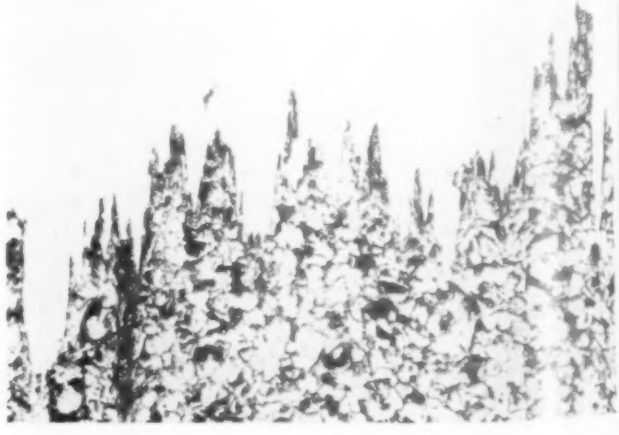


Fig. 12. Profile of ground specimen. Mag 400x

Low Cost Tooling... Estimating and Economics

1—Predesign Estimating

By G. M. Foster
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NORTHERN ELECTRIC COMPANY, LTD.

WHEN WE SPEAK of low cost tooling, we assume low production costs, and also that these low production costs include the cost of tooling. The designer's aim, and it is a challenge to him in all cases, is to arrive at the lowest cost per part produced, bearing in mind that this cost must include tool cost, operating cost and overhead. Should he consider the cost of tools only, he may run up the operating or production cost. If he considers production costs only, he may add to tool costs.

A number of basic factors are included in pre-design estimating. These include:

1. A drawing, sample or description of the part, together with quality-affecting data such as tolerances, limits or end-use of the product.

2. Material from which it is to be made.

3. Total quantity to be made and the quantity required per lot or run.

This may be a single lot, or may be several lots per year for several years.

4. The available toolmaking equipment and toolmaking personnel.

This includes not only the equipment in the toolroom, but also the commercially available items for tool construction: toggle and other clamping devices, jig bushings, die sets and details, interchangeable die units, fixture details and such items as air-operated vises and foot controls which speed up loading and unloading.

In addition to these basic factors, an understanding of motion economy and work simplification, and the application of these principles affect rate of production and production costs.

The urgency of completion of the run affects predesign estimating. Here, of course, economic factors may control scheduling.

From a Paper presented before Seventeenth Semi-Annual meeting, ASTE, Montreal.

The basic factors used in predesign estimating are shown in Table I. The quantity to be made Q is the quantity ordered by the customer, in one lot, or the best estimated quantity per year for a given number of years.

Before estimating T, the tool cost, consideration of the possible methods of manufacture is necessary. The quality desired is also considered. The estimated tool cost comprises the cost of design, labor cost to make the tool, overhead and cost of material.

The estimated maintenance cost M is the sum required for the full period in which the tool is used. This figure will vary with different classes of tools, quantity of production and quality requirements.

Estimated setup cost S includes cost of setup for the full period of use. Operating or production labor cost L includes all overhead—a factor which is too often neglected or not

TABLE I—BASIC FACTORS IN PREDESIGN ESTIMATING FOR ECONOMICAL TOOL COST

ASSUMING:

Quantity	= Q	Total quantity to be made.
Estimated Cost of Tool	= T	Includes labor, overhead and material.
Estmiated Tool Maintenance Cost	= M	Total throughout tool life. This varies from nil if tool is for single run or for low output up to say 10% in cases of dies requiring frequent grinding.
Estimated Set-up Cost	= S	Includes labor and overhead. It is cost per each set-up X total number set-ups required.
Estimated Production Labor Cost	= L	Operating labor plus overhead.
Estimated Cost per Part	= C	

THEN

Estimated Cost per Part = Total Tool Cost ÷ Total Production Cost Quantity

$$\text{or} \quad C = \frac{T + M}{Q} + \frac{S + L}{Q}$$

TABLE II—CASE ONE: POWER SHEAR VS. PRESS

Case—Make 120,000 parts in lots of 30,000. Part 1" x 2" x 1/16" Thick C.R. steel

EST. METHOD #1
SHEAR FROM SHEET ON POWER SHEAR

	30,000	120,000
T = No Tool Cost	.....	.....
M = No Maintenance	.....	.....
S = Set Up	$2.00	$8.00
L = Labor Cost	25.00	100.00
	$27.00	$108.00

$$C = \frac{T + M}{Q} + \frac{S + L}{Q}$$

$$C = \frac{0}{} + \frac{\$8 + \$100}{120{,}000} = \$0.90 \text{ per thousand}$$

EST. METHOD #2
CLIP FROM 2" WIDE ROLL STOCK
USING PUNCH & DIE ON PRESS AT 100 S.P.M.

T = Tool Cost		$25.00
M = Sharpening Die		4.00
S = Set Up		4.00
L = Clipping Operation	$40.00	
Changing Rolls	8.00	48.00
		$81.00

$$C = \frac{T + M}{Q} + \frac{S + L}{Q} \quad \text{OR}$$

$$C = \frac{\$25 + 4}{Q} + \frac{\$4 + 48}{Q} \qquad \frac{2416}{\text{Total Cost}} + \frac{4333}{\text{Labor}} = \$0.675 \text{ M}$$

TABLE III—COMPARISON OF METHODS IN VARIOUS PRODUCTION QUANTITIES

PART: 1 x 2 x 1/16 in. C.R. Steel

QUANTITY 500, 5,000, 10,000 EACH QUAN. IN ONE RUN

	METHOD #1 SHEAR FROM SHEET & DRILL HOLE (3 SET UPS)			METHOD #2 SHEAR FROM SHEET & PERFORATE HOLE (3 SET UPS)			METHOD #3 PERFORATE & CLIP USE ROLL STOCK (1 set up) STOCK ROLLS TO CHANGE		
Q — QUANTITY	500	5,000	10,000		5,000	10,000	500	5,000	10,000
T — TOOL COST	.....	.....	.....	15.00	15.00	15.00	30.00	30.00	30.00
M — MAIN. COST	.....	.....	.....	.....	.....	.....	.....	.....	.....
S — SET UP COST	2.50	2.50	2.50	3.00	3.00	3.00	1.00	1.00	1.00
L — PROD. COST	2.60	25.00	50.00	1.60	15.00	30.00	0.75	2.50	5.00
TOTAL COST	5.10	27.50	52.50	19.60	33.00	48.00	30.75	33.50	36.00

COMPUTE COST PER PART — $C = \frac{T + M}{Q} + \frac{S + L}{Q}$

fully appreciated. In the illustrations to follow they are included as part of estimated cost.

Using these factors of quantity, tool cost, maintenance cost, setup and labor charges, it is possible to find the estimated cost per part C.

$T + M$ is the total tool cost

$S + L$ is the total production cost

These equations, each divided by Q, give the cost per part for tools and production, respectively. Added, they give the total cost per part. They have been shown separately, and as will be shown later, an increase in one may result in a proportionate decrease in the other and a lowered overall cost.

As a specific application of these principles, Table II illustrates a predesign estimate for a simple oblong part 1 x 2 in., of 1/16 in. stock. The total quantity of 120,000 parts will be run in four lots of 30,000 each. There are no close limits, and flatness is of no particular importance.

Equipment available for production includes a power shear and a punch press.

To make the part on the shear, sheet stock will be used; sheared into strips 2 in. wide and further chopped into 1 in. pieces. No tool cost is involved, and maintenance is part of overhead.

The shear must be set up twice for each lot. Setup and production labor charges are shown for each lot of 30,000 and for the whole job of 120,000 parts.

With the press, which it is assumed is equipped with a roll feed, we estimate a tool cost of $25.00 and other costs as shown, or a total of $81.00.

From this comparison it would appear cheaper to provide the tool and use the press, but let us check other considerations. First, slit material in rolls will cost more than the sheets and will occupy more storage space.

Can we work simplify anywhere? In the shearing it was estimated that strips would be chopped one at a time. If they were chopped two at a time that would bring the $100.00 charge down to about $60.00. Thus the total cost on the shear would be $68.00 for the full run, or $.57 per thousand parts.

A similar part, except for the addition of a ¼ in. hole, is shown in Table III. Here a predesign estimate is required for three smaller quantities, each to be made in one run.

In the analysis of the previous case it was learned that two parts at a time could be clipped in the shear, and the labor costs are on the same basis in this illustration. In addition, it will be noticed that no maintenance costs are given: for these small lots none should be needed.

For a quantity of 500, Method I, using the shear and drilling the hole, is by far the cheapest. No special tools are required in this case, of course. At 5,000 pieces, the cost difference among the three methods is reduced sufficiently that other factors may influence the decision. At 10,000 parts, however, there is a decided advantage in using Method III, in which special tooling has been incorporated and in which the operations have been combined.

In Table III it is seen that under certain conditions operations can be combined advantageously. Table IV shows that, given two separate operations with tool cost and production cost equal in both cases, a saving can be made by combining the operations.

This saving is equal to the cost of one operation. However, it may be possible to reduce the cost of the combined tool to less than that of the two separate tools, and thus effect a further saving.

Table V illustrates a case with the combined tool costs less than the cost of the separate tools. Thus if it possible to combine a slow operation with a fast operation and do both at the speed of the faster operation, an additional reduction in costs results. The warning in this case is that there is a possibility that setup and maintenance costs may increase, and thus offset the savings.

TABLE IV—COMBINING OPERATIONS REDUCES COST

Cost of 1 Operation	$C = \frac{T + M}{Q} + \frac{S + L}{Q}$
Cost of 2 Separate Operations	$C = \frac{2T + 2M}{Q} + \frac{2S + 2L}{Q}$
Cost of 2 Operations - Combined	$C = \frac{2T + 2M}{Q} + \frac{S + L}{Q}$
Saving	$\frac{S + L}{Q}$
Cost of 2 Operations - Combined and Tool Cost 25% less than that of 2 separate tools.	$C = \frac{1.5T + 1.5M}{Q} + \frac{S + L}{Q}$
Saving	$\frac{.5T + .5M}{Q} + \frac{S + L}{Q}$

TABLE V—COMBINING BLANKING AND FORMING OPERATIONS TO REDUCE COST

Combined Tool Costs less than total of separate tools. Combined Operation is at speed of Blanking Operation.

	Blanking Operation	Forming Operation	Total Bl. & Form	Combined Operation
Total Cost = T	$40.	$30.	$70.	$50.
Maintenance = M	2.	—	2.	2.
Set-Up Cost = S	2.	2.	4.	3.
Prod. labor = L	4.	30.	34.	4.
Total Cost	$48.	$62.	$110.	$59.

2-Postdesign Estimating

By George S. Clarke

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WHEN A TOOLING estimate is requested, the critical spread is the difference between the estimate, based on present personnel and equipment, and the actual cost of the tooling when completed. It is this difference that tool engineers must control.

As outlined in the previous discussion, a layout is necessary of all the machines, cutting tools, special equipment and devices available, as well as records of normal shop routines and methods. Standardization on tool steel grades is of fundamental importance, from the processing standpoint as well as from the viewpoint of storage and inventory.

The tool engineering department, if it is to return accurate estimates of tooling, must have equally accurate records of feeds and speeds on present equipment. These can be made on work in progress, to save money, but they are more valuable when made under actual shop conditions than are ratings available from the manufacturer. In making these tests it is soon found which are the most economical types of cutters to use, or on grinders the most economical wheel, and these can then be standardized.

Table I illustrates two specific charts made up for machining the popular types of oil hardening tool steels and mild steel. With these charts we now know how long the actual machining will take.

Further tests are then made with the various methods of setting up the work, clamping it and laying it out with the view of simplifying and standardizing these methods. Desirable shop standards include:

Time to set part in vise
Time to change a cutter
Time to change an emery wheel
Time to dress an emery wheel to desired radii or angles
Time to set up angle plate, magnetic chuck or sine chuck
Time required to inspect part between operations
Time allowed for cleaning machine between operations
Time allowed for laying off work
Time allowed for reading drawings
Time allowed for getting tools

Methods should also be standarized. In many shops, each toolmaker has his own pace and method of doing a job. Unless standard methods are available, one man may keep within the estimate, while another may go considerably over it.

Toolmakers themselves should be classified according to skill and type of work they do best. For example, a first-class toolmaker might be rated A, while the apprentice is E. Since obviously estimation would be difficult if the first-class toolmaker were doing work which could be handled

TABLE I—MILLING MACHINE FEED AND SPEED CHART

No. 1-B MILWAUKEE

Helical Plain Milling Cutters

Cutter Diam.	Cutter R.P.M.	Feed - Inches Per Min.	WIDTH OF CUT ½	1	1½	2	3	4
Mild Steel #33								
3	204	6	.55	.27	.18	.14	.09	.07
2½	248	7	.47	.24	.16	.12	.08	.06
Alloy Tool Steel - Medium - #11, 12, 15, 19, 20, 22, 25								
3	93	3 5/8	.78	.39	.26	.20	.13	.10
2½	As above							
Alloy Tool Steel - Tough - #1, 2, 3, 8, 28, 30, 31, 34								
3	52	1 7/8		1.00	.66	.50	.33	.25
2½	As above							

No. 2 MILWAUKEE

Cutter - Plain Helical

Mild Steel #33								
3	195	5¾	1.04	.52	.35	.26	.17	.13
2½	250	7½	.80	.40	.27	.20	.13	.10
Alloy Tool Steel - Medium - #11, 12, 15, 19, 20, 22, 25								
3	93	3½	1.36	.68	.45	.34	.23	.17
2½	As above							
Alloy Tool Steel - Tough - #1, 2, 3, 8, 28, 29, 30, 31, 34								
3	45	1⅜		1.72	1.11	.86	.57	.43
2½	58	1¾		1.35	.90	.68	.45	.34

TABLE II—TIME VALUES FOR MILLING AND GRINDING PUNCH AND DIE PARTS

OIL HARDENING TOOL STEEL

DIMENSIONS		Milling 6 Faces	Grinding 2 Faces	Grinding 4 Edges	Total Mill. & Gr.
Thickness in.	Max. Area Sq. In.	Time in Hours			
0.5	4	.500	.250	.250	1.000
1.0	4	.500	.250	.250	1.000
1.0	25	.750	.250	.500	1.500
1.0	40	1.000	.250	.750	2.000
1.0	80	1.250	.500	.750	2.500
2.0	4	.500	.250	.250	1.000
2.0	15	.750	.250	.500	1.500
2.0	25	1.250	.250	.500	1.750
2.0	45	1.500	.250	.750	2.500

Note:
1. Add 50% of above values for less than two pieces on same job.
2. These figures are based on ⅛ cut max.
3. For high carbon high chrome steel use 125% of above values.
4. For cold-rolled steel or machine steel use 70% of indicated values.

Use of Chart:
1. Determine thickness of stock to be machined.
2. Multiply length by width to obtain surface area.
3. Select thickness, area and read time required for specific machining operation.
4. Transfer reading on Break Down Sheet for Plant Control.
5. For quick estimate use last column which gives total time for squaring up.
6. The figures include set up time.

TABLE III—TIME VALUES FOR DRILLING, REAMING, TAPPING AND JIG BORING PUNCH AND DIE PARTS

OIL HARDENING TOOL STEEL

Size in.	Drill Min.	Drill Ream or Ct. Bore Min.	Drill Ream & Ct. Bore Min.	Drill and Tap Min.
1/8 - 3/8	5	5	5	5
25/64 - 1/2	5	5	10	10
33/64 - 3/4	5	10	10	15
49/64 - 1	10	10	10	15

Note:
1. Above values are for hole depths up to 1½".
2. From 1½" to 3" deep use 200%.
3. From 3" to 5" deep use 400%.
4. Add five minutes for each change of hole size.
5. For drilling in high carbon high chrome steel add 25% to total holes.
6. Jig Boring: a. When boring holes use 200% of above figures.
b. When boring one hole only, add 15 min. for setting up.
c. To lay out die opening use ½ hr to 1 hr.

Example: Drilling

To drill four ¼ screw holes
Drill and ream two ⅜ dowel holes in two settings. 20 minutes should be allowed for the actual operation of ¼ holes and 10 minutes for drilling and reaming ⅜ holes plus 5 minutes each setting up, thus:

4 holes, ¼ dia. and one setting (4 x 5 min.) and 5 minutes	=	25 min.
2 holes, ⅜ dia. and one setting (2 x 5 min.) and 5 minutes	=	15 min.
Total Time:		40 min.

Drilling and Jig Boring of Die Openings

Drilling 11 holes	=	55 minutes
Boring 1 hole	=	20 minutes
8 setting up	=	40 minutes
Total Time		115 minutes or 2 hours on breakdown

TABLE IV—TIME VALUES FOR MILLING [illegible] OPENING, PUNCH AND SHEDDER ON VERTICAL MILLER

TOLERANCE ±.0015 IN. — BASIC LENGTH 1 IN.

Max. Dia. of Cutter	Max. Thickness of stock	TIME IN MINUTES Cold Rolled	Oil Hardening Tool Steel	High Carbon High Chrome
1/16"	1/8"	25	30	40
1/8"	3/8"	15	25	30
1/4"	3/8"	15	20	25
3/8"	1/2"	15	20	25
1/2"	1/2"	15	20	25

Note:
1. Add 50% for setting up; minimum setting up time 15 min.
2. Minimum length of each face 1".
3. For tolerance greater than ±.0015" use 75% of given values.
4. Allow ¼ of these figures for milling taper clearance.

Example:

Max. Dia of Cutter	Thickness of stock	Time per Face	No. of Faces		Total Time
¼"	⅝"	20 min.	7	=	140
⅛"	⅜"	25 min.	2	=	50
			Setting up 50%		190 95
			Total		285 min. or 4.750 hr

satisfactorily by an apprentice, the estimator should be furnished with a chart of the types of work each toolmaker can normally be expected to do.

From these charts, standards and control of toolmakers, the tool engineer can set up time and cost of operations similar to those shown in Tables II to VIII. To provide quick provisional estimates (which can serve as a guide for the design department in selecting a type of tool) the tool engineer can refer to tool records for the past two or three years. The cost of details, tool costs and rates of pay at these periods will be included, as well as a sketch of the overall width and length of the die, and the type of punch and die assembly. This need include only enough information to identify a blueprint of the tool from description, and state whether blank, form, compound, tandem or progressive; and whether first or second-class tool.

A second book is then made up of standard details of tools and as progress is made these details can be revised and allowances made in the punch and die book. In referring to punches and dies, it is understood that the same routine can be applied to other tools and machines.

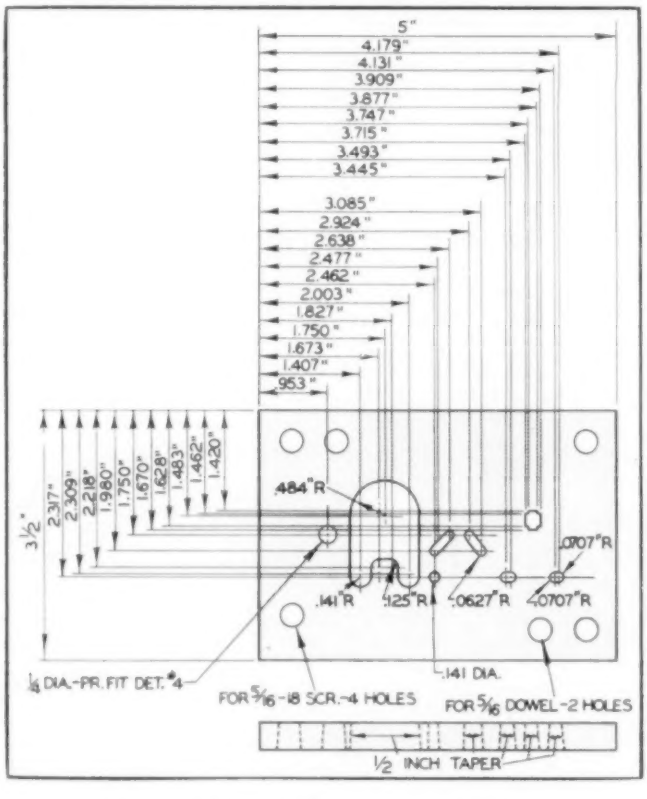


Fig. 1. This is the die used in estimating time and cost values.

In the typical job the first requirements are, of course, the accuracy requirements of the tool and the part produced by the tool. Planning for the production of the tool is the next step, and here the records outlined above aid the estimator. The toolroom layout shown in Table IX need not be planned for all details for each tool, but will be needed for changes in method. For tools which, after try-out, require additional parts or redesign, allowance must be made in overhead charges.

Using the die shown in Fig. 1 as a case history, we can now proceed through the estimating steps. Additional tools will be the time standards, the toolroom layout (Table IX), and the breakdown sheet (Table X). First, the die measures 3½ x 5 in., or 17.5 sq in. The nearest to this on the Milling Time Value Standard is 25 sq in., and as the thickness is not more than one inch, the time allowed for milling the six faces is 0.750 hour. This includes all time for getting the tools, setting up the job and completing the job.

2. Top and bottom faces of the die are wet ground. Time value for this (17.5 sq in.) is 0.50 hr.

3. Grind the four edges on surface grinder. Time is 0.50 hr.

4. Study drawing. One hour is allowed for small calculations such as putting jig borer dimensions on screw and dowel holes, checking piece part drawing with tool drawing, reading layout or consulting with supervisor.

6-7. These jig borer operations are combined to save setting-up time. There are three divisions of time; one in Operation 6 and two in Operation 7. The 2¾ hr include

TABLE V—TIME VALUES FOR CUTTING OUT DIE OPENING ON DO-ALL SAW

TOLERANCE ±.0015 IN. — BASIC LENGTH 1 IN.

Max. Thickness In.	Time in Minutes Cold Rolled	Oil Hardening Tool Steel	High Carbon High Chrome H.S.S.
⅜	10	10	15
¾	10	15	20
1	15	20	25
1¼	20	25	30
1½	25	30	40

Note:
1. Above values include setting up time.
2. Minimum length of each face ½".
3. For tolerances greater than ±.0015" use 75% of given values.
4. Add 50% of total time for dies with overall area exceeding 40 sq. in.
5. Curved lines:
External to a radius add 50%.
Internal to a radius add 100%.
6. For thickness up to 1" allow 5 minutes for each angle cut out.
For thickness above 1" allow 10 minutes for each angle cut out.

Example:
Four faces + eight angles
(4 x 10 min.) + (8 x 5 min.) = 80 min.

TABLE VI—TIME VALUES FOR FILING AND STONING PUNCH AND DIE PARTS

OIL HARDENING TOOL STEEL

Stock to be filed: .003 in. max. on straight lines.
.005 in. max. on curved lines.

±.001 in. Tolerance

	Straight lines	Curved lines				Intersection of lines of curves	
	Per inch of length	½ in. maximum radius					
		External to a radius		Internal to a radius Holes which cannot be bored			
Thickness	Up to 3/8	7/16 to 1 1/4	Up to 3/8	7/16 to 1 1/4	Up to 3/8	7/16 to 1 1/4	Up to 3/8	7/16 to 1 1/4
Time Min.	10	20	15	30	20	40	15	30

Note: A-Die

1. Time for filing faces up to ½" long should be 50% of time required in column.
2. For radius 7/16 to 1" use 150%.
3. For high carbon, high chrome and H.S.S. use 300%.
4. For tolerances ±.00025" use 150%.
5. For stoning after hardening use 75%.

B-Punch and Shedder

6. For filing use 150% of above figures.
7. For stoning punch after hardening use 75%.
8. For stoning shedder after hardening use 50%.

Example: Filing

12 faces (up to ½" long) 3/8 thick ..... 60 min.
8 intersections of lines 3/8 thick ..... 120 min.
Total 180 min.
or 3 hrs.

Stoning

75% of 3 hours ..... 2.250 hrs.

milling, boring and reaming; and the 1 hr is for laying out the die opening.

8. Vertical milling operation to finish close-to-size the blanking die opening and the four small elongated perforator openings. This is also two separate operations: 4¾ hr for milling, and 1 hr for putting in back taper. Derivation of the 4¾ hr in this case is given in Table IV.

9. On the Do-All saw, the rectangular opening is finished within 0.0015 in., for which 1¼ hr are allowed.

10. Time values for filing and stoning are given in Table VI.

12. Top and bottom of die are surface ground after hardening, as shown in Table II. For an area of 17.5 in., this consumes 0.25 hr.

13. Dowel holes are honed as illustrated in Table VII. Since hole diameters are not over 3/8 in., and thickness of material is less than ½ in., this takes 0.25 hr per hole or 0.50 hr for both.

17. Inspection and tryout, according to Table VIII, requires 1 hr.

This completes the estimate for the tool. The toolmakers are assumed to be working at a normal pace, which has been set at that of a man walking three mph.

With such a breakdown, all factors such as getting tools and putting them away are included. If supervisors observe the basic factors and insure against operations being put on the bench which are not on the breakdown sheet, the tool can be completed close to the estimate.

TABLE VII—TIME VALUES FOR LAPPING HOLES IN PUNCH AND DIE PARTS

TOLERANCE ±.0001 IN.
.001 in. Lapping in holes

Thickness of stock	Diameter of holes	Time in Minutes
Up to ½	Up to 3/8	15
7/16 to 1 1/4	Up to 5/8	20

Note: Setting-up time is included in above figures.

TABLE VIII—TIME VALUES FOR ASSEMBLING AND MOUNTING DIES

Blanking Dies

1. Mounting die stripper on shoe ..... 1 to 2 hours.
2. Mounting punches and perforators on punch pad:
   Each punch ..... 1.0 hr.
   Each perforator ..... .5 hr.
   Each pilot ..... .5 hr.
3. Mounting assembled punch pad on punch holder ..... 1½ to 3.0 hrs.

Compound Dies

1. Mounting punch pad, die and backing plate to punch holder ..... 1½ to 3 hrs.
2. Mounting punch and stripper to die shoe ..... 2.0 to 4.0 hrs.
3. Assembling shedders or pressure pads to associated parts ..... 1.0 to 2.0 hrs.

Forming and Miscellaneous Types of Dies

1. For solid die blocks, assembling and mounting allow ..... 1 hr. each.
2. For sectional dies, allow .5 to 1.0 hours for each section.

TABLE IX—TOOL ROOM LAYOUT PERFORATOR BLANK PUNCH AND DIE

1. Mills
   Square up to drawing.
2. Bath Grinder
   Grind two faces.
3. Surface Grinder
   Grind four edges.
4. Bench
   Study drawing.

   Jig Bore:
6. Drill and ream all holes including ones to produce .141 radii, .0627 radii, and .0707 radii. Also 7/16 hole in the rectangular die opening.
7. Bore .484 radius hole for die opening.
   Layout rectangular opening.
   Taper ream die holes.
8. Mills
   Vertical Milling Machine
   a. Mill die opening to drawing.
   b. Mill back clearance with tapered end mill, leaving as little filing as possible.
9. Do-All
   Finish cut rectangular opening within .0015".
10. Bench
    Filing:
    a. Finish file die openings to lines.
    b. Finish file back clearance.

    Stoning:
    c. Stone die openings after hardening.
11. HDN
    #25 steel R.C. 61-63.
12. Surface Grinder
    Grind two faces.
13. Honing
    Hone perforator and dowel holes.
17. Bench
    Recheck and assemble.

TABLE X—PERFORATING BLANK PUNCH AND DIE

TIME—HOURS

		SQUARING		MACHINING BEFORE HARDENING							MACHINING AFTER HARDENING						Bench Assembly	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Detail No.	Mills	Bath Gr.	Surf. Gr.	Bench	Lathes	Drilling	Jig Bore	Mills	Do-All	Filing Stoning	Hdn.	Surf. Gr.	Honing	Univ. Gr.	Jig Gr.	Mould Gr.	Insp. Tryout	Remarks
Die 5	750	250	5	1.000		750	2.000 1.000	4.750 1.000	1.250	3.000 2.250		.250	500				1.000	Saw Layout
Total																		
																Total	Bench Work 7.75 Machine Work 12.5	

Organizing for Cost Reduction

By C. A. Cyrol

A. T. KEARNEY AND COMPANY

NORMALLY, THE TOOL ENGINEER'S field of activity might be divided into the following areas:

1. Actual tool engineering.
   (a) Determine the processes by which the product is to be produced.
   (b) Prepare process sheets for factory use.
   (c) Select the proper machines and/or tools and gages for most economical production of the required parts considering the quantity to be produced.
   (d) Estimate tool-up costs and present them to management.
2. Tool design.
   (a) If the decision is made to produce the product, prepare tool layouts as required by the process sheets.
   (b) Complete designs for all the tools needed.
   (c) Supply detailed drawings to the tool room for the fashioning of all special tools and execute purchase orders for all standard tools that are to be utilized.

Often the tool engineer stops at this point considering his share of the work accomplished. Whether or not his duties have been completely fulfilled depends on the part he wants to accept in bringing about the high productivity that industry must attain. He must become aware of his share in the responsibility of obtaining all the service available in the tools he invents and develops. He must become aware of the functions of all the departments in the industrial organization and thus be able to cooperate with them wherever his sphere of influence touches theirs. The tool engineer's influence and guidance should extend into the following functions.

1. The tool room in its function of making, re-working, repairing, and trying out tools too often becomes a subservient adjunct to the shop and does the shop's bidding. This is not always best for the tools.

2. The tool inspection in its function of inspecting new and repaired tools should be required to report any deficiencies to the tool engineer.

3. The tool trouble-shooting in its function of correcting tool difficulties, checking the operation of new tooling, and investigating bottleneck operations should be required to report the advantages or shortcomings of new tools tried in the shop so that the tool engineer may benefit by the shop experiences and as a consequence supply it with better tools.

4. The tool stores in their functions of storing, disbursing, and accounting for tools used in the shop should be required to keep complete records of tool usage and tool life so that the tool engineer may analyze them to eliminate types of tools giving poor service.

5. Tool maintenance, which too often involves indiscriminate placing of grinders and repair benches on the shop floor so that the foreman or the machine operators can resharpen or repair the tools used by them.

The tool engineer must feel responsible not only for the proper selection and design of tools but also *for their proper use in the shop*. To begin with, tool engineers in industry should sell management on proper tool control and maintenance. From the tool engineer's point of view, tool control will supply him with the statistical data on tool life and usage which will enable him to select and design better tools; however, from the management's angle—and this is the angle that must be stressed if the tool engineer is to reach his objective—effective tool control through properly conducted tool cribs can reduce tool inventories, eliminate considerable tool loss, and allow efficient scheduling of jobs through the shop. For even when the proper materials are delivered to the specified machine or bench and a worker of the required skill is available, all the conditions for scheduled production may not be fulfilled. The proper tools must be available. The tool engineer can argue that although he may specify and design the required tools and these tools may be brought into the plant, they may not be available when they are needed unless they are controlled by strategically located tool cribs. In the case of perishable tools, to insure their continued availability the inventories must be replenished in line with their use; and the tools must be reground and reset as they wear. Thus the tools can also be scheduled to the work center as they are needed, and management attains scheduled production.

Where machine operators are provided with tool grinders spotted throughout the shop so that they may resharpen the small tools that they use, it is obvious that these small tools are being ground away into the dust collectors or discarded to the scrap heap in much greater numbers than management suspects. Small shops which have in the past considered tool control and centralized tool grinding worthwhile only for the large plant are finding that concrete

From a paper presented before the Milwaukee chapter, ASTE.

STANDARD SET-UP AND INSTRUCTION SHEET

TOOLS AND GAGES USED

(1) T03-4766A Aligning tool

(2) Side Tool Holder and 1 Facing Tool (T.C. Tip) H.G. and 1 Recess. Tool (T.C. Tip) H.G. and 1 Chamfer. Tool (T.C. Tip) H.G.

(3) T62-6987 Boring Tool and Holder.

(4) Slotted Tool Holder and Chamfer Tool (T.C. Tip) H.G.

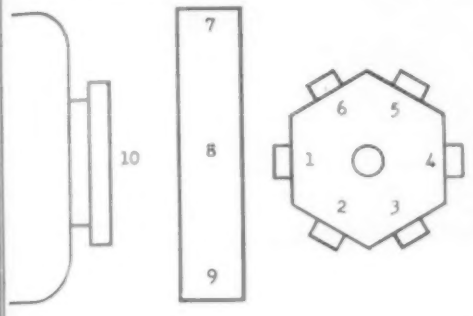
(5) T62-6987A Boring Tool and Holder.

(6-7-8-9) Vacant.

SKETCH OF PART, MACHINE, OR WORK CENTER

(10) T03-6505-L-1 Jaws

Inspection Devices T80-9600 Gage, plug



NAME OF PART Housing, Brush End — Part No. 589-0014

OPERATION Bore and Face Open End — Opr. No. 10

MATERIAL Cast Grey Iron — Dept. No. 3E

MACHINE W & S #3 (Air Chuck) — Mch. No. 412

DESCRIPTION OF OPERATION	FEED	SPEED
Place part in chuck, apply air pressure to hold part, align and apply 60 lbs. air pressure to lock in place.		
Start machine.		
Index turret, rough cut recess, rough face and chamfer.	Hand	352
Index turret, engage feed and rough bore for field.	.012	352
Index turret and chamfer bottom of field bore.	Hand	352
Index turret, engage feed and finish bore for field.	.012	352
Index turret to No. 1 position.		
Stop machine, remove part and place part in a tray truck.		
Inspect for diameter and length of field bore, diameter and length of telescopic fit. Inspect for length of part, over-all.		
No coolant.		

Written By _____ Approved By _____ Date _____

Fig. 1. Set-up instructions clearly stated provide an important informative tool for the engineer in supplying data to the shop

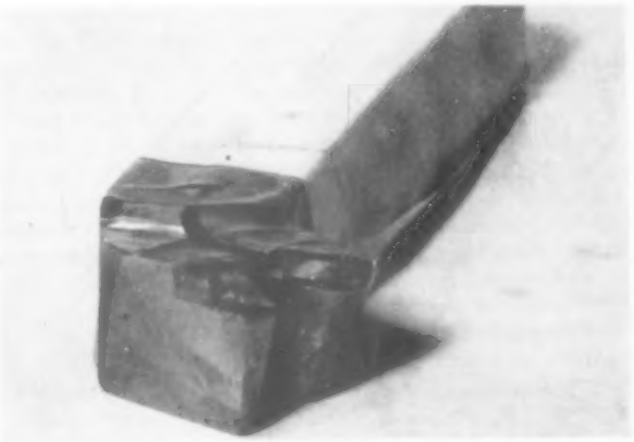
results can be obtained from controlled tool storage and maintenance.

There are many reasons for the installation of centralized tool grinding. Less machine down time is one of them. When machine operators are required or allowed to grind the tools they use, their machines are idle at least during the time that they are resharpening the tools; but they may be idle a longer time than that. The operator may find the grinders in use, and thus machine down time will include *waiting for grinder*, as well as time loss from worker congregation. In cases where no tool control is available to supply the worker with the needed tool when he needs it, the machine down time will also include *looking for needed tool*. If a suitable tool is not found, some other available tool may be *adapted* to the worker's need, and so a good tool may be lost and a poor tool gained. A turret lathe operator, for example, who is expected to maintain his tool setup and resharpen the single point and form tools as well as the drills he might be using, needs about one percent for "Tool Allowance Time" for each tool in the setup or about six percent for a six tool setup. This compares with a two percent allowance needed for a similar setup if the operator returns a dull tool to the crib and gets a reconditioned one. Both figures are from standards established in shops using an incentive wage or piece-work arrangement.

Not only is there more time consumed in tool grinding and looking for tools without effective tool control, but there is also greater machine down time because the inexpertly ground tools and poorly adapted ones fail more often. Of course, with each regrinding, the tool setup must be readjusted; and the possibility of scrap pieces being produced and further losses incurred exists with each such change.

Observations of everyday machine shop practices bring the conclusion that a great amount of tool life is lost through special hooks and clearances that machine operators often add to the cutting tools they use. This type of tool life loss

The tang of this tap was ground down by hand because the tool would not fit holder. Result: one ruined tap.



This tungsten carbide inserted tip failed because it had been incorrectly ground.

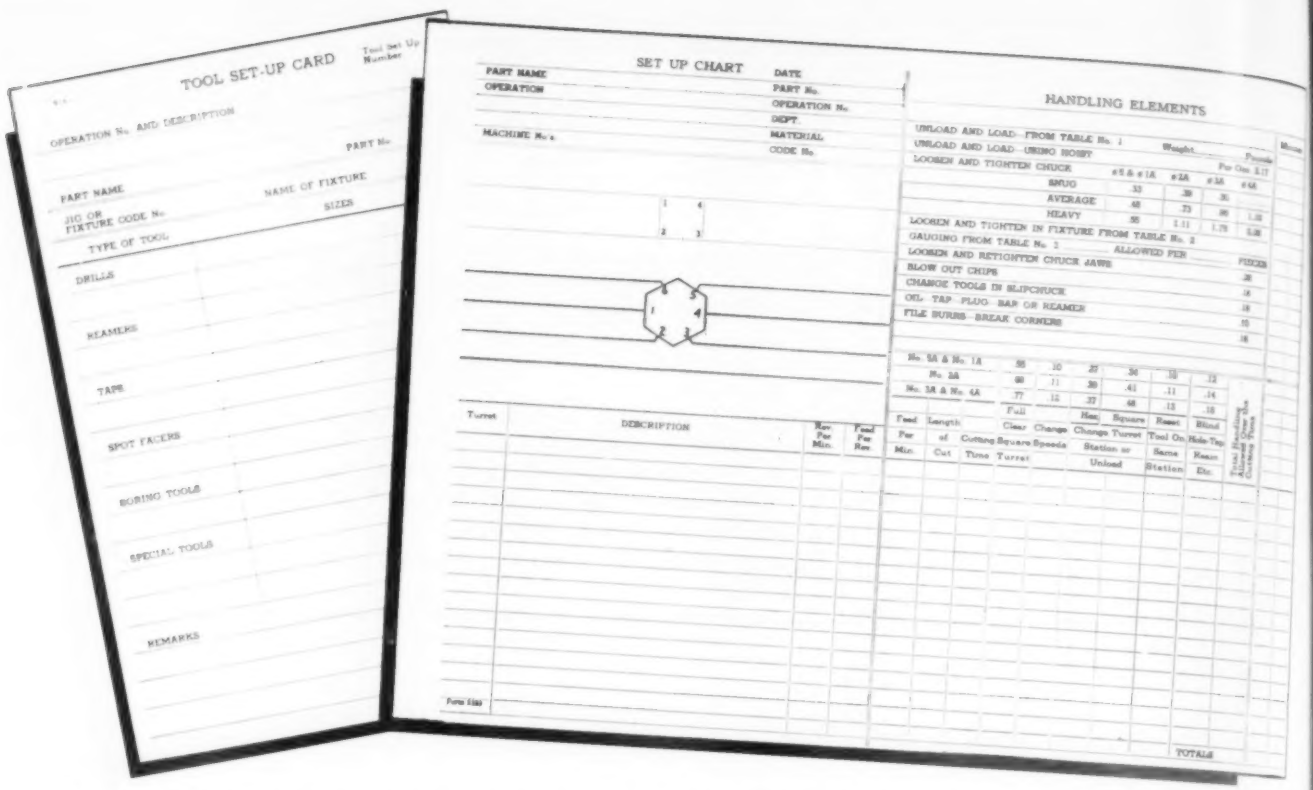


Fig. 2a. These set-up charts provide for accurate listing of work steps and permit correspondingly accurate estimates.

comes from two sources: First, these personal hooks and unusual rake angles are in most cases unnecessary and cause early tool failure; and second, it is conventional procedure for an operator from one shift to remove all such special hooks and so forth and add his own before using the tools.

For the most part, we have been talking about cutting tools; but who, with shop experience, has not seen drill jigs or milling fixtures mutilated to compensate for wrong dimensions on forgings or castings?

As an additional argument for centralized tool control and maintenance, a cleaner shop is possible through the use of an efficient central dust collection system, which is not always practical for general floor stand grinders. A centralized tool grinding organization can provide more specialized and effective equipment and personnel than a system where individual operators grind their own tools. The equipment required for the correct handling of tungsten carbide tools, for example, is best left in the hands of persons trained in the technique of this work. The advantages of properly fashioned tungsten carbide cutting tools are well known to the tool engineer, but it is not enough to specify such tools on the operation sheets, if their use and maintenance is not explained to the shop personnel and if the shop personnel is not supervised so that all the superior properties of the tools are realized.

This idea that specialized knowledge must be available to supplement the knowledge of the foreman and the worker is not new. In the evolution of scientific management principles, Frederick W. Taylor became convinced that the responsibilities of the old-line foreman were greater than could be carried out by the men available. He therefore divided these responsibilities among different men who were especially qualified for their special functions. In setting forth his recommendations, Taylor indicated that the general foreman should be replaced with four functionalized foremen: he called them:

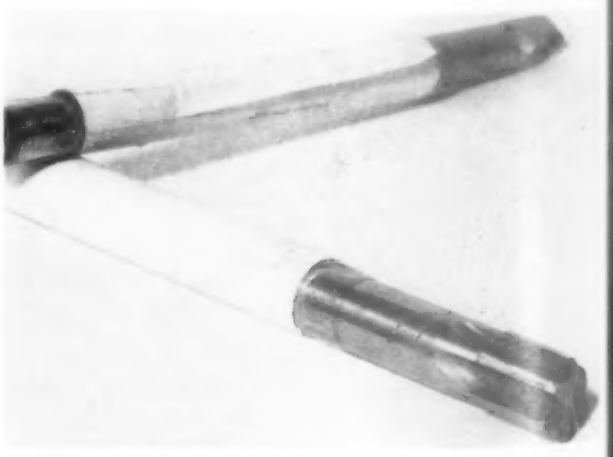
1. The gang boss
2. The speed boss
3. The inspector
4. The repair boss

The speed boss, according to the principles outlined, would supervise the use of proper tools for each piece of work, the proper feeds and speeds and depths of cut, and the proper setting of the tools. It would seem that the tool engineer would be the one to fill this function.

Under practical shop conditions, the tool engineer can best supply this information to the shop through blueprints of all tools used in the shop and instruction cards which specify these tools by name and number and indicate their position in the setup, Figs. 1 and 2. The blueprints can be kept on file and used to guide the resharpening of tools dulled in use, and the instruction sheets can be kept on file in the tool crib in the shop so that each time a setup is made the proper tools are properly arranged on the specified machine.

Reduction in grinding wheel inventory is also possible by adoption of such a system because:

1. The wheels can be more correctly dressed, mounted and thoroughly used up.
2. The designated type and grade of wheel is used for each job.



Another case where an inserted tip of tungsten carbide, incorrectly ground, resulted in loss of the tool.

TURRET LATHE STANDARD DATA SHEET

PART NAME — Part No.
OPERATION — Oper. No.
Dept. No.
E. M. O.
MACHINE NAME — Mach. No's.

Table 1
MANUAL UNLOAD AND LOAD

Regular	Min.	Weight	Min.	Weight	Min.
1	32		.33	10	.40
2	33	2	.34	30	.50
3	34	3	.35	50	.60
4	35	4	.36	60	.65
5	36	5	.37	65	.70
6	37	6	.38	80	.78
7	38	7	.40	90	.81
8	39	8	.41	95	.86
9	31	9	.42		
10	32	10	.43		

Table 2
CLAMP IN FIXTURES

TYPE	1	2	3	4
Set Screws	.60	.70	1.00	1.30
Slotted Clamps	.60	.70	1.00	1.20
If Ram. Nuts—Add	.30	.30	.30	.60
Bar Clamps Per Nut Removed	.65	1.10	1.80	1.80
Index Fixture Complete	.11	1.80	2.80	3.80

Table 3
GAUGING

ALLOWED PER DIMENSION	
Micr. O.D.	.21
Micr. I.D.	.27
Depth Micr.	.36
Check Length	.18
Thread Gauge	.30
Plug Gauge	.18
Profile Gauge	.18

ADDITIONAL ELEMENTS

TOTAL

DOWN TIME ALLOWANCE

TYPE OF DELAY	Time	Per Cent
Personal		
Normal Delay		
Tool Gain		
Rough Tools		
TOTALS		

PREVIOUS RATE — PREVIOUS SET UP

REMARKS

CALCULATION OF RATE

Total Actual Time Per Piece
Plus ____ % Allowances
Total Production Time
Plus 25% Incentive Adj.
STANDARD MINUTES PER PIECE
SET UP TIME

Computed By — Checked By — Tool Equip Record By
Date of Study — Approved By — Date Posted

Fig. 2b. Above is another typical instruction sheet, incorporating necessary details for reliable cost control. Such data sheets, based on shop time values, enable the tool engineer to keep a close check on each job.

ORIGINAL LABOR COST OF MAGNETIC PLUG

"U" Magnet	1.3110	
Plug and Assembly	7.2200	
Total		8.5310

LABOR COST REDUCED THROUGH METHOD AND TOOLING CHANGE

"U" Magnet	.6800	
Plug and Assembly	7.2200	
Total		7.9000

LABOR COST FURTHER REDUCED THROUGH MINOR DESIGN AND TOOLING CHANGE

"U" Magnet	6800	
Plug and Assembly	5.8105	
Total		6.4905

LABOR COST STILL FURTHER REDUCED THROUGH MAJOR DESIGN AND TOOLING CHANGE

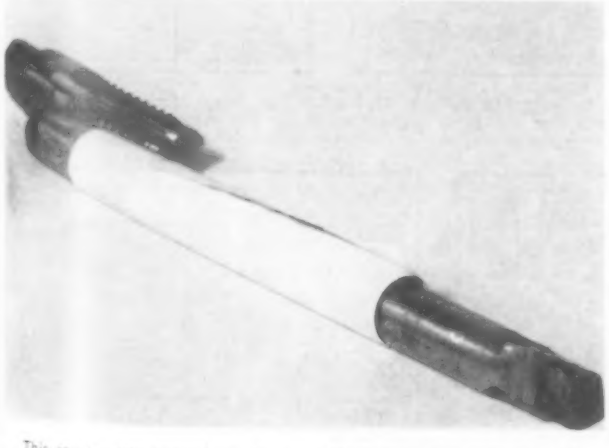
"U" Magnet	6800	
Plug and Assembly	2.1610	
Total		2.8410

Fig. 3. Typical savings possible through careful attention to possibilities for product redesign.

If templates are used, a smaller number of them will suffice the grinding room than would be necessary for proper distribution in the machine shop. Standard carbide bits can be stocked and reshaped in the grinding room as necessary, thus both reducing the inventory of special bits carried and making the required tool available in the shortest possible time. Tool life can be prolonged. Expensive carbide tools can be called in every so many hours of cutting time, the cutting edges inspected, and resharpened as required *before* total failure and damaging fractures of the inserts occur.

No practical investigation can be made into the subject of tool life and tool usage in the shop without tool control and proper tool maintenance. The additional cost of tungsten carbide tools is, for example, warranted only if these tools are correctly used. Before practices in the shop with respect to tools can be improved, they must be controlled so that correct tools and setups are supplied to the operator when a job is scheduled in the shop. The tool engineer may be able to demonstrate through comparison of alternative methods that 25 percent to 50 percent of the operation time can be saved by means of the application of proper tool feeds and speeds. However, without tool control and maintenance such savings cannot be translated into actualities in the shop; because without this control, there is no insurance that the operator will use the proper tools time after time. And when the specified tools are not used, the expected savings in time cannot be realized. If management is to enjoy all the cost-reducing potential in the tools that tool engineering science can provide, it must allow the tool engineer to exercise control over tools because:

1. Tools must be built according to the original design.
2. Tools must not be changed without specific instruction and permission from the tool design department.
3. Changes in tooling required due to engineering changes as indicated by engineering releases must be authorized by the tool design department.
4. Whenever changes are necessary, the tool drawings must be altered so as to reflect the changes made in the tooling.



This reamer was ground on the end. The center was removed, and reamer is beyond repair. Tool control could have prevented this.

The full cooperation of management is essential in cost reduction programs; in one typical instance it enabled the tool engineer to reduce by 66 percent the man-hours required for a product. In this case, the product, an oil plug, was manufactured before the war in relatively small quantities; and only a normal amount of attention was being paid to the man-hours needed for the operation involved. However, when designers of war machines specified this special plug for power transmissions, hydraulic control units, tank engines, tractors, pumps, and other similar mechanisms, the manhours needed to fill the unprecedented demand became a paramount issue. Not accepting the addition of man-power and manufacturing facilities as the only way to meet the delivery schedules, the company, through subsequent analysis, was able to reduce the man-hours needed for the manufacture of its largest volume plug to one-third its original requirement (Fig. 3).

Fig. 3 shows in summary the steps that were taken and the results obtained. At the beginning of this man-hour reduction program, the methods then current were examined and standardized. Some small changes in methods and layout were made as a result of a motion and time study analysis of the processes. The shop routings were studied and correlated to actual shop practice whenever necessary, and actual cost information was accumulated and carefully checked. Thus a "bench-mark"—a collection of facts relating to the item under consideration—was established and the program proceeded from that point forward.

Design of Fixture Elements

Clamps

By Hans W. Smith

LOCATING AND SUPPORTING the workpiece in the fixture are preliminary to clamping; the work must be held securely in place so that it will not move during the operation. Clamps should be so designed that they can be quickly removed to unload the work. Most clamps are set on springs so that they can be turned or withdrawn easily.

A simple form of clamp, the strapclamp, is shown in Fig. 1. It is held down by a bolt or screw with a handwheel for turning. To avoid taking off the screw for each unloading the clamp is slotted permitting it to slide off the work as shown at right. Is addition it is so placed that by turning it ninety degrees it will clear the work.

Sometimes it may be necessary to take off the clamp completely to unload the work. To avoid taking the clamp screw off, which would take too long, the clamp can be shaped as shown in Fig. 2 and slipped off under the bolt head.

For simple, rough fixtures, such as a welding fixture, an open end strapclamp cas be easily made by bending square stock into a horseshoe shape.

Another way of taking a clamp off without removing the clamp bolt is to provide a hole in the clamp big enough to pass over the bolthead and use a washer under the bolthead which is slotted, making it a "C" washer. After loosening the bolt, the washer comes off and the clamp is taken up over the bolt. A clamp can also be made to exert pressure on more than one part. For example, a clamp holds down two different work parts by making that part of the clamp which bears on the work a hinged piece with two properly dimensioned button heads.

Second of a series of articles on the principles of jig and fixture design, embodying particular emphasis on basic design factors.

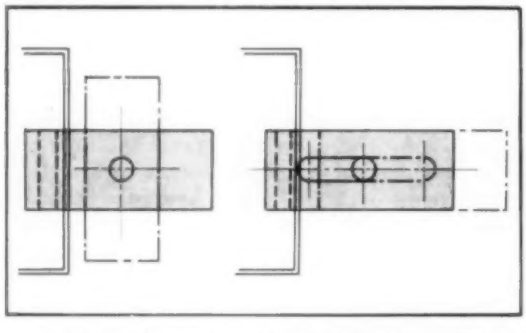
Cam Clamps

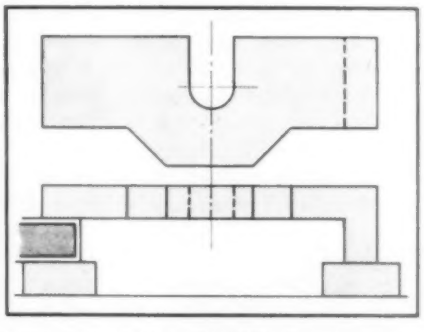
The cam clamp is frequently a strapclamp with a cam as the member which supplies the clamping force. Such clamps have the advantage of quick action. They will clamp securely only for a definite height of stock thickness, and therefore must have some sort of adjustment to accommodate variations. If these variations occur too frequently, changing the setting offsets the quick clamping advantage. For steady conditions, however, the clamp if accurately machined, is very practical. On milling machines, where chatter may be encountered, its use is not recommended.

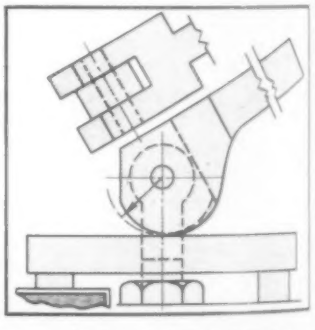
Fig. 3 shows a straddle cam clamp; that is, the cam straddles the clamp bolt with its adjustment nut. The clamp is a strapclamp with welded-on heel to rest on the fixture and strap to rest on the work. The arrow points to an arc from the center of the pin and the variation of the cam contour from this arc is the relief and clamping action when turning the cam. The cam should rise one sixty-fourth radially in one-fourth inch circumference.

A removable type of cam clamp is shown in Fig. 4. The strapclamp is hinged to a cam but held in elongated holes, alowing some up-and-down movement of the clamp. The hinged pin projects on either side to engage in an open slot in the clamp bracket. The slot is slightly tapered to prevent slipping back of the clamp in tightening.

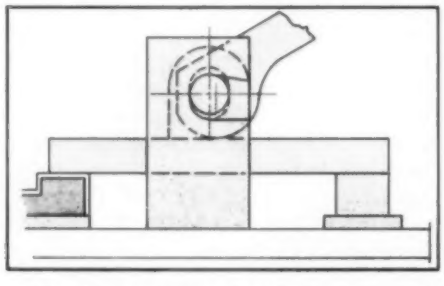
In Fig. 5 is shown a cam clamp where the cam bears directly on the work. It also shows an adjustment feature.

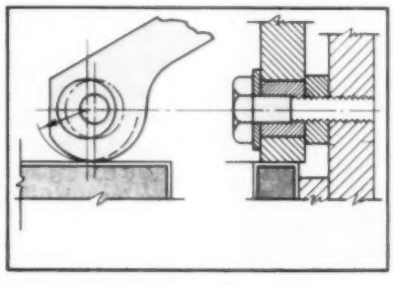






(Left) Fig. 1 illustrates the strapclamp, held down by a bolt or screw, with a handwheel for turning. (Center) Fig. 2. Shape of this clamp permits its removal without taking off the clamp screw. (Right) Fig. 3 shows the straddle cam clamp, so called because the cam straddles the clamp bolt with its adjustment nut. Cam clamps offer quick action on work without variations in height.





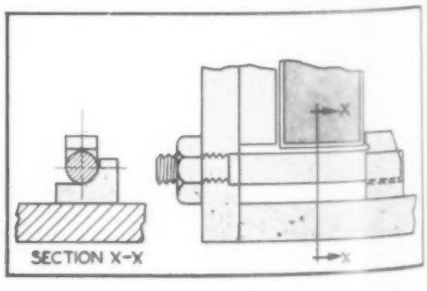


Fig. 4 (left) strapclamp hinged to a cam. Also having an adjustment feature is the cam clamp in Fig. 5 (center). Fig. 6 (right) employs a hook bolt to clamp the work, since there is not sufficient room for an ordinary clamp.

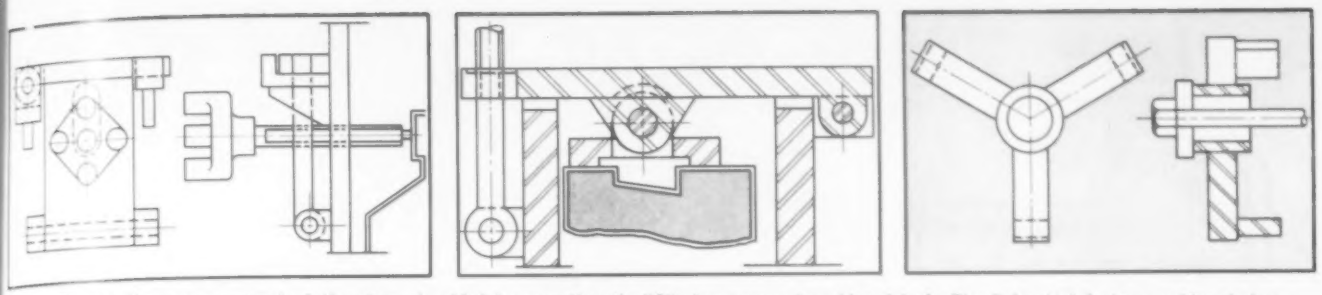


Fig. 7 (left) Here easy removal of the clamp is aided by mounting the "C" clamp screw in a hinged leaf. Fig. 8 (center) features a hinged shoe which acts as an equalizer. The clamp in Fig. 9 (right) is designed to bear on the work in three places.

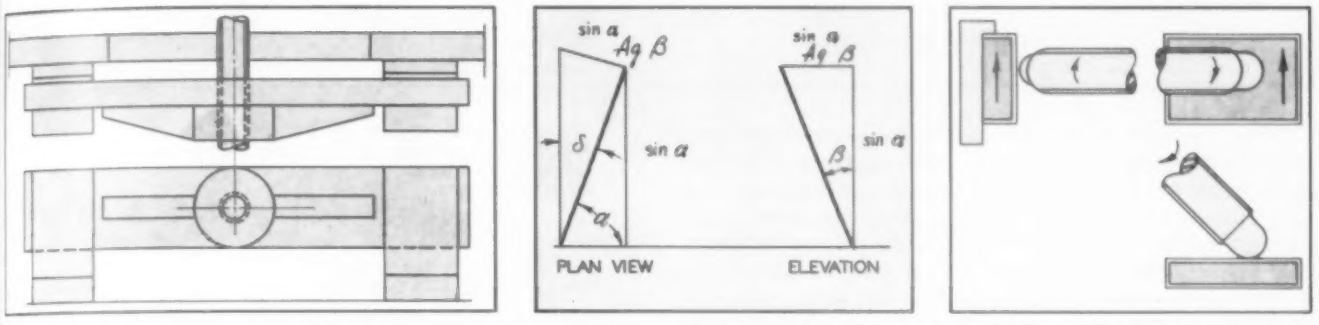
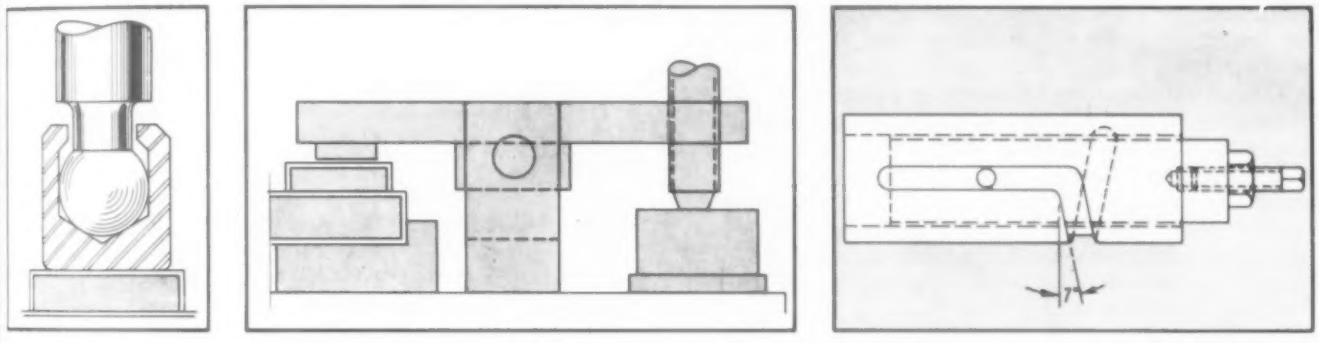


Fig. 10 (left) A loose gate is used here to replace the hinged gate shown in Fig. 7. Fig. 11 (center) illustrates the construction for locating true angle in drilling. Fig. 12 (right) shows directions in which spherical contacts will move in tightening.



The swivel-end shown in Fig. 13 (left) permits rotation of the screw while the swivel rests firmly on the work. In Fig. 14 (center) the loose block permits quick clearance for unloading. Fig. 15 (right) shows a bayonet design for clamping.

gained by having the cam turning around a bushing with an eccentric hole. When set, the bushing is held in place by a washer and cap screw. The bushing is slightly higher than the cam, which allows the cam to rotate freely. The eccentricity of the hole shown by the two centerlines is one-half of the adjustment.

A hookbolt can be used to clamp the work where there is not room enough to employ an ordinary clamp (Fig. 6). To be effective, the hook must be as close to the shank of the bolt as possible. In addition, the shank must be supported against bending, which would cause the hook to slip off the work. In the illustration, this support is shaped so that it will also keep the bolt from turning, when the nut is tightened. The shape of the support allows the hook one-quarter turn for loading and unloading. There is no need to hold the bolt or to turn it into position. Tightening and loosening the nut will by itself turn the hook into the proper position. The hook nut, which really is a special washer with a short wing to clamp the work, is satisfactory when the thickness of the work does not vary much.

Frequently clamping members must be placed where they would interfere with loading unless made removable (Fig. 7). Here removal is accomplished by mounting the "C" clamp screw in a hinged leaf. The leaf is locked in place by a latch, dropped in place after the leaf is closed.

Fig. 8 shows a design similar to Fig. 7, but the clamping pressure is applied by a hinged shoe, an equalizer, which permits an even pressure to be exerted on two places of the work. Pressure is applied by using an eyebolt and a handwheel (the latter not shown) which forces the leaf or gate down. To keep the eyebolt from crawling out during tightening or through vibrations, the leaf is slightly counterbored for the size of the seat of the handwheel as shown. The width of the gate is a close slip fit in the fixture wall.

A loose clamp capable of the bearing on the work in three points is shown in Fig. 9. It has a large hub and hole to permit removal over the head of the clamping bolt. For tightening, a "C" washer is slipped under the head of the bolt. A similar clamp employing machined flats can be used to exert pressure in three places. Where variations in thickness on the work are expected, the machined flats on the clamp should be replaced by spherical buttons.

In connection with spiders and three point clamps (Fig. 9) spherical washers and seats are employed under clamps where the work is round in shape or where slight variations from a plane surface must be expected. The hole in the clamp must be large enough to permit the angular movement which the washer will accommodate.

Instead of a hinged gate as shown in Fig. 7, a loose gate can be used, in most cases at less cost, as seen in Fig. 10. Also, when the gate becomes very large, a hinged design is too unwieldy. The guides into which the gate is dropped for use must be strong enough to take the pressure that the screw will exert.

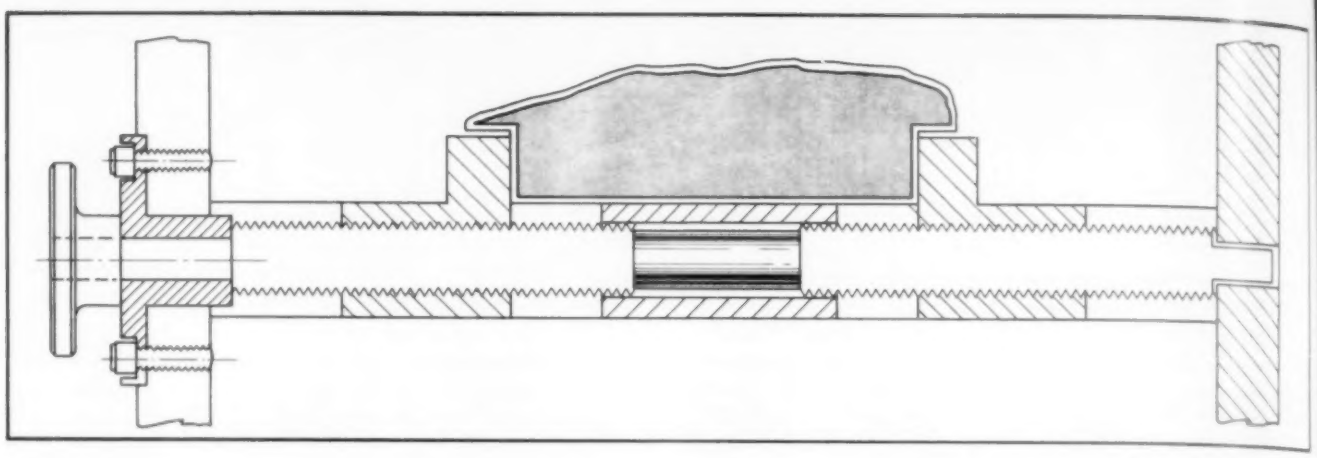


Fig. 16 (above). Comparing this design with the one shown in Fig. 15, it can be seen that the clamp above permits turning of the screws, but no longitudinal motion. Jaws are kept from turning by traveling in slots.

When the work is clamped directly by a screw, the screw can be set so that it will push the work against all three stops and at the same time press down against the rest. The screw is tilted under a compound angle to the three square faces of the fixture and so exerts pressure in three directions. The tapped holes for a screw under a compound angle are drilled by setting the fixture on the drill press under an angle which does not appear true in any of the regular views. The true angle is shown by construction in Fig. 11 as well as by calculation from the angles alpha and beta taken from the regular views. The true angle delta is used for the set-up under the drill press, and should be given on the drawing.

The axis of the screw is shown as a heavy line in two projections. Let in the plan view a certain length of the line be unity. Then the sin α appears directly in this view. This same length appears in the elevation, containing the angle 6. Therefore the height of the triangle in the elevation is sin α Ag 6. This height is used in the plan view to construct a triangle over the side assumed before as unity. This triangle contains the true angle α which, as can be seen from the illustration, is Ag δ=Ag 6.

In cases where a screw hits the work under an angle, its end should be of spherical shape to provide proper contact. In tightening, the screw has a tendency to move the work (Fig. 12). The direction in which it will move the work can be seen by studying the spherical end in three views. If this direction is not the desired one, namely the one toward the stops, one may resort to a left hand thread, thus reversing the direction of the push.

Better than the spherical end of the screw is a swivel-end (Fig. 13) which permits rotation of the screw while the swivel-end rests firmly on the work. The shoe is peened over toward the neck of the spherical end in assembly.

To gain clearance on a clamp for unloading, the clamp screw is on some designs unscrewed (Fig. 14). This is a time-consuming operation that should be cut to a minimum. The illustration shows a loose block which can be quickly removed, giving the required clearance.

Clamping pressure can also be exerted by a bayonet (Fig. 15). The long straight slot is used for quick withdrawal while a helical groove next to this slot will permit exertion clamping pressure by turning the plunger. A set screw and nut is provided for adjustment. Where it is necessary to clamp the work between two jaws in such a way that the center line between the jaws stays in the same place regardless of the variation in thickness of the work, clamping jaws can be used operated by right and left threads. The design shown in Fig. 16 permits turning of the screw but no longitudinal motion, while the jaws are kept from turning by traveling in slots. The size of the handwheel employed to turn the screw determines the amount of pressure one wants to permit.

Occasionally the clamping problem is different from the one stated above in that the work is not intended to be held on a certain centerline (Fig. 17). It is assumed that the work is already centered at some other point, but should be held by two jaws at whatever place it happens to be, and regardless of variations in size. Then the equalizing clamp shown here may be used. The screw is kept from turning by a tongue, but may move back and forth. It can "float" for an amount shown as clearance next to the collar pinned to the screw. This collar exerts pressure on one jaw. The other jaw is pushed against the work by a nut with a handwheel. A jamnut with a handle permits to lock the device after clamping. In operation one jaw will move up to one face of the work and then the other moves up and tightens.

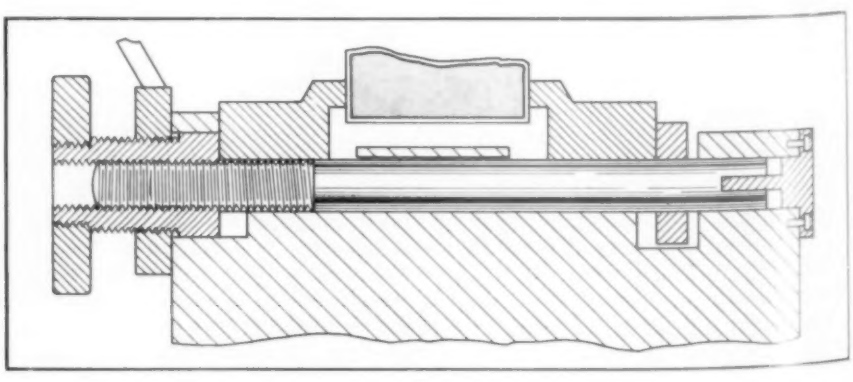


Fig. 17 (right) illustrates a design where the work is not intended to be held on a certain centerline, and use of an equalizer is advantageous. Screw is kept from turning by a tongue, but may move back and forth. It can "float" for the amount shown as clearance next to the collar pinned to the screw.

Pre-Finishing Surface Requirements for Mill Forms

By Edward Engel

CONSULTING ENGINEER, COLONIAL ALLOYS COMPANY

OTHER THAN articles made from sheet or machined stock, a large variety of mill forms are regularly plated and anodized, with and without previous machining, grinding or forming. In a general manner, some of these forms are outlined.

Die Castings

Aluminum die castings usually have high silicon contents which simplifies casting thin cross sections and gives longer die life, thereby reducing casting costs. Unfortunately, the high silicon aluminum alloys are more difficult to anodize for decorative finishes. They are more difficult to machine and are harder on cutting tools than other aluminum die casting alloys.

Therefore, when pleasing anodic finishes are required or where considerable machining is to be done, magnesium-aluminum or, at least, low silicon aluminum die castings should be investigated.

While it is possible to obtain dark shades on high silicon aluminum die castings, the bright colors or a natural lustrous finish can not be obtained in commercial anodic production.

Although not ready for commercial application, a method has been developed for plating pure aluminum on silicon aluminum die castings. This process holds some promise as an approach to bright anodic finishing in all colors. And, since we are on this subject, it may be said this method also may enable steel objects to be anodically-colored to present a great degree of corrosion protection, together with a pleasing appearance.

Zinc alloy die castings, Nos. 21, 23, 25 (ASTM. Specs.) are popular alloys. The last named has the smoothest surface. Zamak alloy No. 3 is somewhat stronger than aluminum die castings, but it weighs 2½ times as much.

Zinc is generally cast in plunger-type machines which are faster than aluminum die casting equipment. A good die, working with zinc, may last up to 300,000 to 500,000 shots.

In both aluminum and zinc, die castings which are to be plated or anodized should be specified as "Hardware-Finished".

Lost Wax (Investment) Molding

This process offers possibilities in the casting of small intricate parts. It provides smoother surfaces, as well as less porosity, cold-shut areas and surface defects than die casting. A surface smoothness of 5 micro-inches has been obtained.

These moldings are not competitive in large production quantities with die-casting methods, but where aluminum is contemplated, and decorative anodizing is to be performed the process should be investigated. The present size limitation is under 9 inches in the longest direction and about 4 inches in the other dimensions.

Permanent Mold Castings

Castings produced by the permanent mold process have a better color, but more porosity and less surface smoothness than die castings. More machining may be required than for die castings. More complex, closer and smaller cores are workable in die castings than in permanent molding. Three degrees greater draft is required when casting aluminum in a permanent mold than in die casting.

Alloys of aluminum, magnesium and copper, in the order listed, are the usual permanent mold castings. Aluminum alloys Nos. 122 and 142 (QQ-A-696) have low silicon content, so they present fair surface conditions for pleasing anodic finishing. Permanent moldings are made in sizes up to about a 55 in. dimension.

Plaster of paris moldings have limited availability. This method, as the name indicates, uses plaster of paris instead of molding sand. Since the latter material is smoother than sand, a smoother surface results. Closer tolerances also may be obtained than by sand molding. The process is more suited for making match-plates, however, than for direct casting molds.

Sand castings are offered in practically all metals. As a rule, sand castings are poor subjects for decorative plating or anodizing.

In high production runs of small- or medium-sized sand castings, metal match plates and metal copes or drag-patterns are used in molding machines.

Aluminum

There are numerous aluminum alloys offered to meet general or specific requirements. For examples (1) alloy numbers 220, 195 and 141 have high strength; (2) for ease of casting and pressure tightness numbers 47, 352 and 43 alloys present suitable properties; (3) number 355 alloys permits intricate castings with high strength; (4) alloy number 352 has the highest impact resistance. The general purpose alloys are numbers 12, 112 and 212.

Heat-treatable alloys, as a rule, have less porosity, greater strength and better machinability than the non-heat-treatable aluminum alloys. However, some non-heat-treatable alloys, such as one produced by Oscar W. Hedstrom Corporation, are said to have properties comparable to the heat-treatable types.

If an assembly of an aluminum sand casting and a common wrought-aluminum alloy is to have a uniform appearance after anodizing, the cast alloy should be No. A-214 or equivalent.

Brass castings respond much like wrought copper alloys to plating processes. Such castings have wide application in plumbing fixtures and hardware.

Cast iron, such as the seven classes listed in ASTM-A-48-41 specification, permits inexpensive castings with a wide variety of applications.

In addition to cast iron, there are about 70 steel alloys and several malleable iron alloys which may require plating.

TABLE I—FORGING OPERATIONS AND EQUIPMENT

TYPES	OPERATIONS	MACHINES	PURPOSES
Drop forging	Drop hammer, dies, anvil; may be successive steps	Hydraulic steam press, power hammers	Shop size billet for working
Upsetting	Building up of material at some point by axial compression	Bolt-heading, upsetting, nail machines	Bolts, nuts
Forming	Pressing metals into shapes with dies	Forging rolls, steam presses, forging and hydraulic presses, coining and sizing presses	Shaping large pieces, boiler heads and bar stock
Drawing-out	Lengthening of stock under impact or pressure	Trip, steam or air hammers, forging rolls or presses	Working large billets, bar stock
Edging	Forming ends of bar stock with dies	Trip or valve hammers	Shaping operations for bar stock
Trimming	Cutting excess metal away, flashings from drop forgings	Sizing presses, power hammers	Semi-finish operations
Fullering	Forming bar stock; shaping between dies	Trip or valve hammers	Shaping operations for bar stock
Swaging	Working shapes between dies	Trip, helve, rotary hammers; swaging machine	Surface working
Embossing	Forcing into relief part of surface	Forging press, power press	Surface working
Coining		Sizing presses	Frequently cold surface working
Straightening	Semi-finishing	Power or forging presses	
Ironing	imparting high finish; squeezed between dies	Power presses	Cold or hot finishing operation
Planishing	Smoothing or truing by blows or dies	Trip, helve, power presses	Cold or hot finishing operation
Shearing	Parting of metal	Vertical or alligator shears	Preparation of stock for forging
Hot cutting	Hot chiselling or slice bar	Power or forging press	Trim
Forge weld	Joining pieces	Power or forging press	
Punching	Piercing through stock by shaped tool	Power or forging press	
Piercing	Hollowing with mandrels	Mandrel and power hammer and piercing roll	Seamless tubing; first steps in forging rings
Extruding	Metal forced through dies	Extrusion presses	Manufacturing of intricate and varied shapes

Malleable irons, such as ASTM Specification A-47-33, grades 35018 and 32510, are the most machinable of the alloys of equal strength. These specification alloys have good ductility and fairly smooth surfaces. Malleable iron is somewhat more difficult to plate than cast iron.

Tolerances

Casting and screw machine product tolerances compare as follows:

Castings	1/32 to 1/16 in.
Screw machine products	0.0002 in.
Powdered metals	0.0005 in.
Die castings	0.001 in.

Comparative Costs

In lots of 5,000 there seldom is any difference in cost between sand and die castings. For quantities over 5,000 the cost progressively favors the die castings, until in about 30,000 lots, dependent on size and intricacy, the cost of the latter is about 30 to 40 percent less than sand casting.

Extruded Shapes

The cold-formed extrusions are offered in thicknesses of from 1/16 to ¼ in., and in lengths of from a few inches up to 80 feet. The maximum weight of aluminum extrusions is about 350 lb. A new process has been developed for extruding thinner gages of aluminum and with smoother surface when chemically polished may eliminate the need of mechanical polishing and buffing.

The use of extrusions wherever possible reduces machining and polishing costs, decreases final weight and results in less waste of metal.

Drawn and extruded tubing: Seamless tubing is either extruded or drawn. Extruded tubing may also be further reduced on the draw bench. In draw bench operations the use of carbide mandrels together with careful handling avoids pitting.

Impact Extrusions

Impact extrusions are economical in certain shapes and cross sectional thicknesses, and some of the shapes produced by this process are not available by other methods. Impact extrusions are porosity-free. They are formed in a single operation, except for trimming which is rapid. Little scrap occurs, and very smooth surfaces result if smooth dies are operated.

Some impact extruded shapes include:

1. One piece seamless tubes, with or without bottoms.
2. Tubes similar to the above, but with recessed bottoms.
3. The bottoms of the tubes may be projected or bossed and they may be made thicker than the sides.

Forgings offer advantages over castings in both strength and surface finish. Less porosity is present, and blow-holes are less likely to occur.

Within their shape limitations aluminum forgings (except 32S) provide a better choice than die castings or other castings if a pleasing anodic finish is desired. Shape again permitting, forging may even result in a lower final cost than die casting, particularly if considerable machining is required in the latter process. In addition, the appearance of anodizing aluminum forgings, as compared to the rather drab appearance and comparatively low corrosion resistance of anodizing die castings, increase the market value of the product.

The Use of Analytic Geometry In Tool Design

By John R. Parks

THE PROBLEMS OF TOOL design are essentially geometric, involving straight lines, circles and combinations of them. The design checker using propositions of trigonometry and geometry calculates critical points and dimensions to find if the tool 'fits' the part to be machined—essentially this is algebra. The designer, the checker and the toolmaker use the fundamentals of analytics in everyday work.

This paper will deal with the co-ordinate axes, the graph, various equations of and related to the straight line and the circle and the applications of these equations to examples in design.

A proposal was suggested in 1619 by Renes Descartes which is familiar in some form to all draftsmen and tool designers. This proposal was to start the algebraic analysis of geometry problems with an X-axis and a Y-axis at right angles to each other. The point of intersection is the zero point for both lines. The Y-axis divides the X-axis into a plus part on the right and a minus part on the left, similarly the X-axis divides the Y-axis. Fig. 1 illustrates this.

Suppose we set a divider to one inch and use it to step off points on the X-axis to the left and the right starting with the zero point. Again starting with the zero point as '0' the points to the right may now be numbered 1, 2, 3 etc., and to the left, -1, -2, -3 etc. This same thing can be done with the Y-axis so that the positive numbers are towards the top of the sheet and negative numbers are towards the bottom.

In the preceding the draftsman will recognize the horizontal and vertical center lines he often uses. The tool designer recognizes the edges of the planes by which he locates the part in the tool that he is designing. The toolmaker sees the base lines he uses for his layouts.

Fig. 1 shows a problem of five holes. It is required that the four holes A, B, C and D determine two lines AB and CD. These intersect in point P such that P lies within a circle of radius 0.005 in., whose center coincides with the center of hole E. The first method usually used to solve this problem is the fifteen times layout, or a scale of fifteen to one. On this scale one sixty-fourth of an inch approximates 0.001 in., and it can be readily seen whether the lines intersect as desired or not. This method is in common use, but often it proves a cumbersome tool. The second method is to use propositions from geometry and trigonometry to calculate the position of the point of intersection of lines AB and CD and compare with the specified position of hole E.

Another problem that bobs up in the design of circular form tools is stated pictorially in Fig. 2. The question is do circles A and B intersect in point P as dimensioned?

Fig. 3 indicates another problem that is met fairly often in tool design. The boss A lies relative to the edges of a plate as shown. In the overall picture the engineer recognizes that it is to his advantage to use the faces B and C of the boss as location surfaces. The problem becomes one of referring the centers of holes D and E to a new set of co-ordinate axes X' and Y'. Here trigonometry is used.

As a final example Fig. 4 gives a problem that is attacked by both the fifteen times layout and trigonometry. In this problem it is required that line A be tangent to the circle of centers B.

In the following discussion it is assumed that readers are familiar with the elements of geometry and algebra. It is also assumed that a calculating machine is available.

Referring to Fig. 5, assume the previously-discussed X and Y axes, with a curve arbitrarily drawn across the sheet. If an equation in x and y can be set up for the curve just drawn then it is clear that the x and y numbers of each point the pencil passed through must satisfy the equation when they are substituted in the equation. Now this process can be reversed. If an equation is at hand the curve it represents can be determined by finding those x and y numbers that satisfy the equation and plotting them on a sheet of paper on which a set of axes has been drawn. For example:

$$2x + 3y - 1 = 0 \qquad (1)$$

Solving this equation for y the following is obtained:

$$y = \frac{1 - 2x}{3}$$

Now by substituting various values for x we may calculate the corresponding values for y and tabulate them as follows:

x	y
0	1/3
1	-1/3
2	-1
3	-1 2/3

By plotting these pairs of numbers on a sheet with a set of coordinate axes the curve representing equation (1) is obtained as shown on Fig. 6. This curve is a straight line. Mathematicians have taught us that the curves represented by equations of the form of equation (1) are straight lines.

The point marked P_1 on the line in Fig. 6 has coordinates

$$x_1 = -4; y_1 = 3$$

Substituting these values in equation (1) the following results:

$$2 \times (-4) + 3 \times 3 - 1 = 0$$

or

$$0 = 0$$

The results indicate that the coordinates of the point $P1$ satisfy equation (1). Another way of stating the same thing is that the straight line represented by equation (1) passes through any point whose coordinates satisfy it. To further illustrate this consider the point P_2 which does not lie on the line. Its coordinates are: $x_2 = -3$ $x_2 = 2$

Upon substituting these values in equation (1) we get

$$2 \times (-3) + 3 \times 2 - 1 = 0$$

or

$$-1 = 0$$

This result is not true and it may be said that the coordinates of a point that does not lie on the line do not satisfy the equation.

SOME PROPERTIES OF EQUATIONS OF STRAIGHT LINES

Mathematicians have shown that equations of the form of equation (1) represent straight lines in a plane. In general, then, equation (2) should denote some straight line in the plane out of all the lines that can be drawn.

$$ax + by - 1 = 0 \qquad (2)$$

Where a and b are any numbers, positive or negative or zero. In this equation x and y take on only those values which, substituted in the equation, will reduce the left side

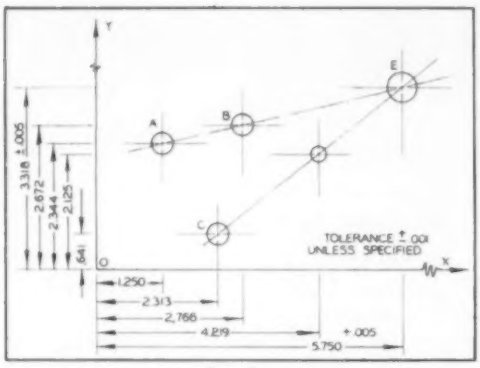


Fig. 1

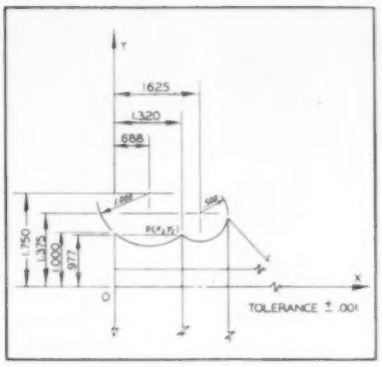


Fig. 2

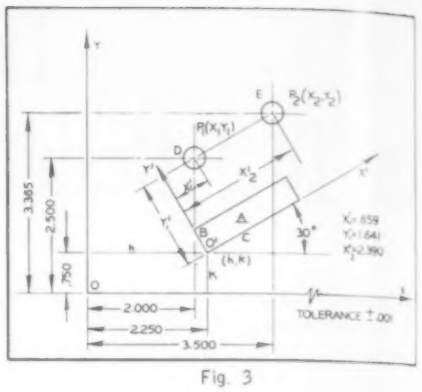


Fig. 3

to zero. An example of an equation of a straight line follows:

$$-1.305\,x + 3.142\,y - 1 = 0 \qquad (3)$$

In geometry it is known that two points determine a straight line. It should be possible, then, to use the coordinates of two given points to determine algebraically the equation for the line that is geometrically determined by the two points.

Let us assume that the straight line represented by equation (2) passes through the two points A and B in Fig. 1, the coordinates of which are:

A	B
$x_1 = 1.250$	$x_2 = 2.766$
$y_1 = 2.344$	$y_2 = 2.672$

Since point A lies on the line then its coordinates must satisfy equation (2). In which cases we have

$$a \times 1.250 + b \times 2.344 - 1 = 0$$

and similarly for point B we get

$$a \times 2.766 + b \times 2.672 - 1 = 0.$$

Here we have two equations in the two unknowns, a and b.

$$\begin{aligned} 1.250 \times a - 2.344 \times b &= 1 \\ 2.766 \times a - 2.672 \times b &= 1 \end{aligned} \qquad (4)$$

These two equations can be solved simultaneously to obtain the values of a and b. When this is done the equation of the line determined by points A and B in Fig. 1 can be stated. Equations (4) are solved in the following manner.

Suppose it is decided to calculate the value of b first; then we must proceed to eliminate a from both equations. This can be done by multiplying the first equation by (-2.766) and the second by (1.250), thus we get

$$(-2.766) \times 1.250 \times a + (-2.766) \times 2.344 \times b = -2.766$$

and $(1.250) \times 2.766 \times a + (1.250) \times 2.672 \times b = 1.250$

Now if these two equations are added term for term we obtain the following:

$$3.3400 \times b - 6.4835 \times b = 1.250 - 2.766$$

or $$-3.145 \times b = -1.516$$

whence $$b = \frac{1.516}{3.1435} = .4823 \qquad (5)$$

The value of a may now be calculated by substituting this value of b in either of the equations (4) whichever is easier to handle. Let us choose the second, then we have

$$2.766 \times a + 2.672 \times .4823 = 1$$

or $$2.766 \times a = 1.0000 - 1.2887$$

whence $$a = \frac{.2887}{2.766} = -.1044 \qquad (6)$$

Now that the values of a and b have been calculated the equation of the line determined by the points A and B in Fig. 1 can be written as follows;

$$-.1044 \times x + .4823 \times y - 1 = 0$$

on multiplying this equation by (-1)

$$.1044 \times x - .4823 \times y + 1 = 0 \qquad (7)$$

The process, just illustrated, of solving two equations simultaneously is a very important one and should be studied carefully. It can be used to give the solution of the problem posed in Fig. 1. The reader will recall that the problem is to find whether the lines AB and CD intersect in a point that lies within the tolerance of point P as it is dimensioned.

Suppose for the moment that the equations of the lines AB and CD are known; also let it be assumed that the lines intersect in the point P the coordinates of which are x_1 and y_1 and are unknown. Since the point P is common to both lines then its coordinates, x_1 and y_1, must satisfy both equation (7) and equation (8), the equation of line CD.

$$.6713 \times x - .8622 \times y - 1 = 0 \qquad (8)$$

Substituting x_1 and y_1 in equations (7) and (8) the following are obtained;

$$\begin{aligned} .1044 \times x_1 + .4823 \times y_1 &= -1 \\ .6713 \times x_1 - .8622 \times y_1 &= 1 \end{aligned} \qquad (9)$$

It is immediately understood that here the same method is used to determine x_1 and y_1 as was used to calculate the values of a and b in the previous case.

The coordinates of the point of intersection of lines AB and CD are therefore

$$x_1 = 5.7517 \qquad y_1 = 3.3178$$

whereas the coordinates of the center of hole E in Fig. 1 are

$$x_1 = 5.750 \pm .005 \qquad y_1 = 3.318 \pm .005$$

Thus it is shown that the design checks, but what is more important the position of the point of intersection of the two lines was accurately determined.

Fig. 7 illustrates the method of solving the problem presented in Fig. 3. The problem is essentially one of referring a point to a new set of coordinate axes, the new set having been rotated and displaced relative to the old set. In Fig. 7 the angle A denotes the amount of rotation of the new axes from the old, and h and k, which are x and y coordinates of the zero point of the new set referred to the old, represent the displacement of the new axes from the old. Analysis, for which there is no need here, has shown that when the old dimensions (coordinates), x and y, of point P in Fig. 7 and the rotation and displacement of the new axes are known, then the new dimensions (coordinates) are given by equations (12).

$$\begin{aligned} x^1 &= (y-k)\ \mathrm{SinA} + (x-h)\ \mathrm{CosA} \\ y^1 &= (y-k)\ \mathrm{CosA} - (x-h)\ \mathrm{SinA} \end{aligned} \qquad (12)$$

Fig. 3 gives the data for point P as follows:

displacement: $h = 2.250$; $k = .750$

rotation: $A = 30$ deg

old coordinates of P: $x = 2.000$; $y = 2.500$

Substitution of these values in equations (12) gives the solution

$$\begin{aligned} x^1 &= (2.500-.750)\ \mathrm{Sin30^\circ} + (2.000-2.250)\ \mathrm{Cos30^\circ} \\ y^1 &= (2.500-.750)\ \mathrm{Cos30^\circ} - (2.000-2.250)\ \mathrm{Sin30^\circ} \end{aligned}$$

whence $$\begin{aligned} x^1 &= .6585 \\ y^1 &= 1.6405 \end{aligned}$$

Another formula of great use to the tool engineer and toolmaker is one by means of which the distance between two points is calculated. If the coordinates of the points P_1 and P_2 are given as $x_1 y$, and x_2, y_2 respectively the distance s between the two points is given by equation (13).

$$s = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \qquad (13)$$

Fig. 6 also illustrates another useful theorem, one which gives the method for calculating the distance d from a point

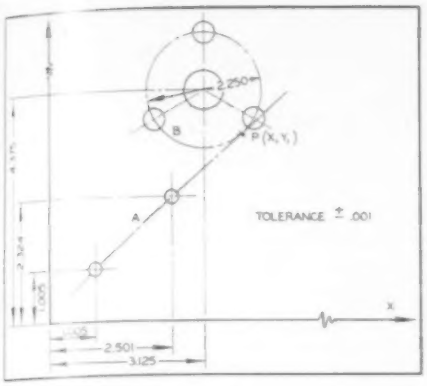


Fig. 4

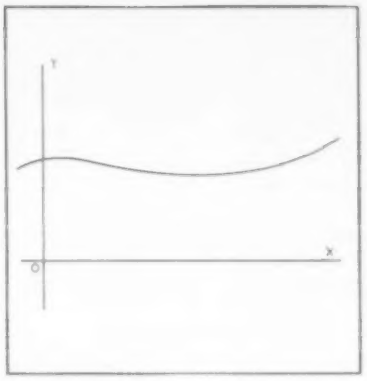


Fig. 5

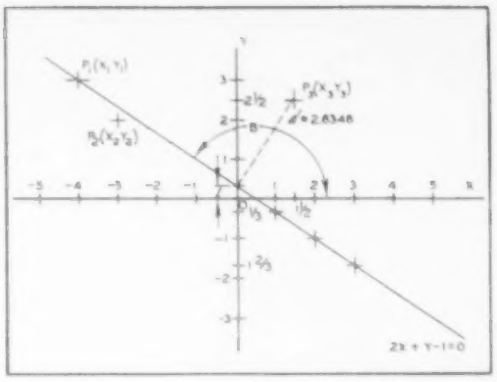


Fig. 6

P_3 whose coordinates are x_3, y_3 to a line whose equation is in the general form of equation (2) or

$$ax + by - 1 = 0 \qquad (2)$$

The distance d is found by equation (14).

$$d = \frac{ax_3 + by_3 - 1}{\sqrt{a^2 + b^2}} \qquad (14)$$

To apply this equation to Fig. 6 we proceed as follows. The figure provides these data:

coordinates of P: $x_3 = 1.500$; $y_3 = 2.500$

and the equation of the line: $2x + 3y - 1 = 0$ (1)

Comparing equation (1) and (2) it is seen that: $a = 2$; $b = 3$. Upon substituting these values in equation (14) the distance d can be found.

$$d = \frac{2 \times 1.500 + 3 \times 2.500 - 1}{\sqrt{2^2 + 3^2}}$$

or

$$d = \frac{9.500}{3.6056} = 2.6348 \qquad (15)$$

The equation of the straight line can be expressed in other useful forms. One of these is given by equation (16).

$$y = mx + l \qquad (16)$$

In (16) m is called the slope of the line and y is the y-intercept. Analysis is this question will show that

$$m = \text{TanB} \qquad (17)$$

where B, as shown in Fig. 6, is the angle the line makes with the positive direction of the x-axis and is measured in the counter-clockwise direction from it. It should be remembered that the tangent of an angle that is less than 90 is positive and the tangent of an angle that is greater than 90 but less than 180 is negative. As implied by equation (16) both m and l may be any value positive, negative or zero. This may be put in a table as follows:

$$\begin{aligned} &\text{Tan B} = + \text{ when } 0° < B < 90° \\ &\text{Tan B} = - \text{ when } 90° < B < 180° \end{aligned} \qquad (18)$$

As seen in Fig. 6 l is positive or negative depending on whether the line crosses (intercepts) the y-axis above or below the vero-point 0.

Equation (2) can be transformed into equation (16) by solving it for y. If this is done equation (18) is the result.

$$y = -\frac{a}{b} + \frac{1}{b} \qquad (19)$$

Comparing this equation with (16) it is seen that

$$m = -\frac{a}{b} \text{ and } l = \frac{1}{b} \qquad (20)$$

The point of the preceding is that after the equation of a straight line has been determined from the coordinates of two of its points additional information can be obtained from it by means of equations (18) and (19). As an example in a previous part of this article equation (7) was found for line AB in Fig. 1.

$$.1044 \times x - .4823 \times y + 1 = 0 \qquad (7)$$

To put (7) in the form of (16) merely solve for y.

$$\text{or} \quad y = \frac{-.1044}{-.4823} \times x + \frac{-1}{-.4823} \qquad (21)$$

From equations (20)

$$m = \text{TanB} = .21646$$

$$\text{and} \quad = l \quad \frac{1}{b} = 2.0734$$

And therefore it may be inferred that line AB in Fig. 1 makes an acute angle of 12° 12′ 43″ with the positive direction of the x-axis and crosses y-axis 2.0734 inches above the zero point 0.

SOME PROPERTIES OF THE CIRCLE

Equation (13) can be used to develop the equation of the circle. Suppose that the coordinates of any point on the circle are x and y and the center is the zero point, the coordinates of which are $x_2 = 0$ and $y_2 = 0$. Let the radius be 2 inches. By equation (13) the following data are obtained: $s = 2$; $x_1 = x$; $y_1 = y$; $x_2 = 0$; $y_2 = 0$

Substituting these in equation (13) we get

$$2 = \sqrt{(x-0)^2 + (y-0)^2}$$

or

$$x^2 + y^2 = 4 \qquad (22)$$

From this equation it is easy to infer the general equation of a circle of any radius r, and whose center is at the zero point of the axes.

$$x^2 - y^2 = r \qquad (23)$$

This equation is illustrated in Fig. 8 as circle A.

Equation (13) can also be utilized to develop the general equation of a circle the center of which lies at some point other than at the zero point. Circle B in Fig. 8 illustrates this problem. From it and equation (13) the following data are obtained:

$$s = R;\ x_1 = x;\ y_1 = y;\ x_2 = h;\ y_2 = k$$

Upon placing these values in equation (13) we arrive at the following expression;

$$(x-h)^2 + (y-k)^2 = R^2 \qquad (24)$$

This is the equation of a circle of radius R and whose center is the point where x and y coordinates are h and k.

It is now possible to write the equation of the circle of centers B, in Fig. 4 before solving the problem in that figure. Examination of Fig. 4 yields these data on circle B: $R = 1.125$; $h = 3.125$; $k = 4.375$

Substitution in equation (24) results in the following equality:

$$(x + 3.125)^2 + (y - 4.375)^2 = 1.125^2 \qquad (25)$$

To reduce this to a more usable form the operation of squaring the quantities inside the parentheses should be performed. Thus: $x^2 - 6.250 \times x + y^2 - 8.750 \times y + 27.640625 = 0$ (26)

It will be shown a little later why six decimal places have been retained in this equation. This form of the equation for a particular circle is the more useful one for calculating the coordinates of points that lie on the circle. Suppose that it is proposed to calculate the x coordinates of the points on circle B in Fig. 4 that have a y coordinate given equal to 4.000. Fig. 4 is to scale; if the reader will lay a straight edge across the figure parallel to the x-axis and

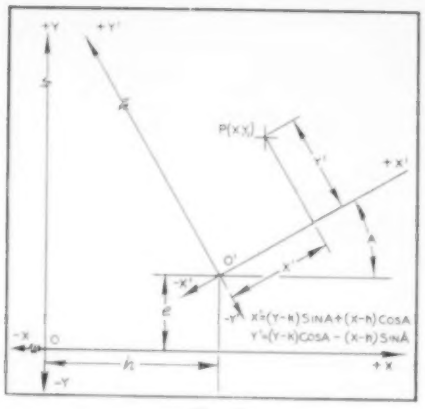


Fig. 7

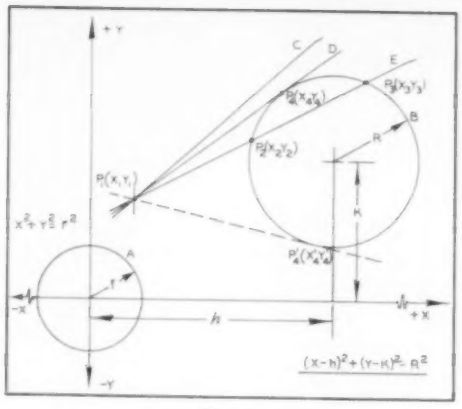


Fig. 8

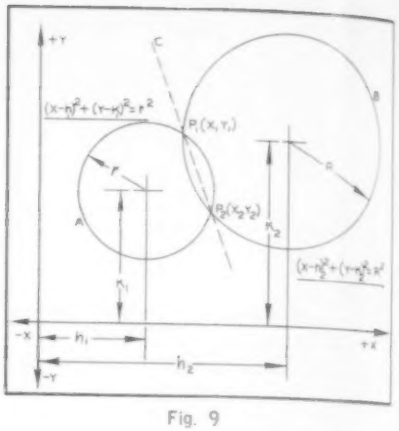


Fig. 9

approximately through $y = 4.000$, it will be seen that the straight edge crosses the circle of centers in two points. The x coordinate of each of these points is to be calculated. Substituting 4.000 for y in equation (26) we obtain

$$x^2 - 6.250 \times x + (4)^2 - 8.750 \times (4) + 27.640625 = 0$$

This reduces to

$$x^2 - 6.250 \times x + 8.640625 = 0 \qquad (27)$$

Quite a few years ago mathematicians showed that equations of the form of (27) are satisfied by two values of x only, and these two values are called the roots of the question. Equation (27) can be written in the form called a quadratic equation.

$$a \times x^2 + b \times x + c = 0 \qquad (28)$$

In this equation the quantities a, b and c are not to be confused with those used in preceding parts of this article, but are to be taken only as positive or negative numbers such as those in equation (27).

The formulas for the roots of equation (28) are as follows:

$$x_1 = \frac{-b + \sqrt{b^2 - 4 \times a \times c}}{2 \times a} \qquad (29)$$

$$x^2 = \frac{-b + \sqrt{b^2 - 4 \times a \times c}}{2 \times a} \qquad (30)$$

With two relations the x-coordinates of the two points on circle B in Fig. 4 whose y-coordinate is 4.000 can be calculated. Comparing equations (27) and (28) we see that:

$$a = 1;\ b = -6.250;\ c = 8.640625$$

The calculation of the first root is

$$x_1 = \frac{-(-6.250) + \sqrt{(-6.250)^2 - 4 \times (8.640625)}}{2 \times (1)}$$

$$x_1 = \frac{6.250 + \sqrt{4.500000}}{2} \qquad \frac{6.250 + 2.1213}{2}$$

$$x_1 = 4.1857$$

and

$$x_2 = \frac{6.250 - 2.1213}{2}$$

$$x_2 = 2.0644$$

Here the desired x-coordinates have been calculated to a reliability in the third decimal place. It is for this reason that the numbers in equations (26) and (27) were carried to six places. The coordinates of the points of intersection between the circle in Fig. 4 and a line whose equation is $y = 4.000$ have been calculated and those coordinates are

$$x_1 = 4.1857 \quad \text{and} \quad x_2 = 2.0644$$
$$y_1 = 4.000 \qquad\quad y_2 = 4.000$$

In general a line will interest a circle in three possible ways:

1. It may intersect the circle in two distinct points P_2 and P_3 as shown in Fig. 8 line E.
2. It may intersect the circle in only one point as in the case of line D. Line D is said to be tangent to the circle. In this case it is customary for mathematicians to say that the tangent line D intersects the circle in two coincident points. This can be seen if the reader will imagine the line rotated about point P from position E to position D. The points P_2 and P_3 will approach each other and finally coincide at P_4.
3. In this case the line C intersects the circle in no points.

In the preceding example it was illustrated how the straight line the equation of which was: $y = 4.000$; intersected the circle whose equation was

$$x^2 - 6.250 \times x + y^2 - 8.750 \times y + 27.640625 = 0$$

in two distinct points by the aid of equations (29) and (30). This was done by solving the preceding pair of equations simultaneously thus obtaining equation (27). This equation was then solved by the aid of (29) and (30), the formulas for the roots of a quadratic equation.

In general the simultaneous solution of any straight line and any circle will result in an equation like (27), the general formulation of which is given by equation (28). The roots of such an equation are found using (29) and (30). A close examination of these two equations shows that:

1. If $b^2 - 4 \times a \times c =$ positive number (31)

The values of x_1 and x_2 are different and distinct and therefore the line intersects the circle in two distinct points as in the case of line E in Fig. 8.

2. If $b^2 - 4 \times a \times c = 0$

The values of x_1 and x_2 are equal since they reduce to

$$x_1 = x_2 = \frac{-b}{2a} \qquad (33)$$

This indicates that the line intersects the circle in but one point and therefore must be tangent to the circle as shown by line D in Fig. 8. Equation (32) is a test of tangency and is an important equation.

3. If $b^2 - 4 \times a \times c =$ negative number (34)

Then the line intersects the circle in no points since the values of x_1 and x_2 can not be computed: the square root of a negative number can not be taken.

We are now in position to solve the problem depicted in Fig. 4. The problem here is to determine if line A is tangent to circle B. By application of the ideas discussed in earlier parts of this article the equation of line A is found to be

$$-7.4147 \times x + 8.4097 \times y = 1 \qquad (35)$$

The equation of the circle has already been found to be (26).

$$x^2 - 6.250 \times x + y^2 - 8.750 \times y + 27.640625 = 0 \qquad (26)$$

To solve (35) and (26) simultaneously we solve (35) first for y as follows

$$y = .8817 \times x - .1189$$

and substitute in equation (26) thus

$$x^2 - 6.250 \times x + (.8817\,x + .1189)^2 - 8.750 \times (.8817\,x + .1189) + 27.640625 = 0 \qquad (36)$$

Upon performing all the indicated arithmetic in this equation it reduces to

$$1.777395 \times x^2 - 13.755207 \times x + 26.614387 = 0 \qquad (37)$$

Now according to the discussion of equation (32) if for (37)

$$b^2 - 4 \times a \times c = .000000 \qquad (38)$$

the line A in Fig. 4 is tangent to the circle at least within the given tolerance of 0.001 inch.

To evaluate equation (38) the following data are taken from (37): $a = 1.777395$; $b = -13.755207$; $c = 26.614387$. Upon computing the terms of equation (38) and contracting the values to six places of decimal we find

$$b^2 = 189.205720$$
$$-4 \times a \times c = -189.217114$$
$$\text{or} \quad b^2 - 4 \times a \times c = -.011394$$

From previous discussion of equation (34) our problem is solved: line A intersects the circle in no points—it misses the circle entirely.

Another method of solving this problem is to use equation (14) which gives the distance from a point to a line in terms of the coordinates of the point and the constants of the equation of the line.

$$d = \frac{a \times x_1 + b\, y_1 - 1}{\sqrt{a^2 + b^2}} \qquad (14)$$

Where x_1 and y_1 are the coordinates of the given point and a and b are from the equation of the line given by

$$a \times x + b \times y - 1 = 0 \qquad (2)$$

From Fig. 4 the following conclusions regarding equation (14) are readily arrived at.

If the distance from the center of the circle to the line A is less than, equal to or greater than the radius 1.125, the line intersects the circle in two points, is tangent to it or does not intersect it at all. From Fig. 4 and equation (35) we obtain the following data: $x_1 = 3.125$; $y_1 = 4.375$; $a = -7.4147$; $b = 8.4097$

Substituting these values in equation (14) we get

$$d = \frac{(-7.4147 \times (3.125) + (8.4097) \times (4.375) - 1}{\sqrt{(-7.4147)^2 + (8.4097)^2}}$$

$$d = \frac{12.62150}{11.21164} = 1.1257 \qquad (41)$$

whereas the radius of circle B is $1.125 \pm .001$

Since the distance from the center to the line is 0.0007 greater than the radius of the circle the line does not intersect the circle. However considering the tolerance, the line can be said to be tangent to the circle in Fig. 4 within the tolerance specified.

Both methods given here for solving the problem in Fig. 4 give the same answer but it should be noted that equation (38) is a very sensitive test. The former method illustrates the procedure for solving the equation of a straight line and the equation of a circle simultaneously and will come in handy in solving the problem depicted in Fig. 2.

Fig. 2 illustrates part of a form tool. The problem here is to calculate the position of the point P_2 (x_2, y_2), the intersection of the two circles, without reference to the dimensions given for the position of the point. In a general way Fig. 9 represents the problem. Here are shown two circles with the radii and coordinates of the centers given as r, (h_1, k_1), R and (h_2, k_2). When the values of these quantities are substituted in the equations shown on Fig. 9 and the resulting parts of these equations are squared, two equations similar to (26) are obtained. The two equations may be represented as follows:

$$x^2 - \mathrm{P} \times x + y^2 - \mathrm{Q} \times y + \mathrm{T} = 0 \qquad (40)$$
$$x^2 - \mathrm{p} \times x + y^2 - \mathrm{q} \times y + \mathrm{t} = 0 \qquad (41)$$

where P, Q, T, p, q and t are numbers like those in equation (26) and may be positive, negative or zero. To obtain the coordinates of the points of intersection P_1 and P_2 on Fig. 9 equations (40) and (41) must be solved simultaneously. In this instance the procedure begins with the subtraction, term by term, of equation (40) from equation (41). This leads to the following:

$$(P - p) \times x + (Q - q) \times y - (T - t) = 0 \qquad (42)$$

It can be seen that by dividing this equation by the quantity $(T - t)$, it reduces to an equation of the types of (1), (2) and (3): in other words it is the equation of a straight line. Mathematical analysis which will not be reproduced here shows that if (40) and (41) represent the circles A and B in Fig. 9 then equation (42) will represent line C. This line passes through the points of intersection of the circles. Immediately it is seen that the coordinates of P_1 and P_2 are obtained by solving equation (42) simultaneously with either (40) or (41) by the method already presented in solving the problem shown in Fig. 4.

Let us proceed to solve this problem. Inspection of Fig. 2 and Fig. 9 provides the following data for circles A and B:

Circle A		Circle B	
h_1	= .688	h_2	= 1.625
k_1	= 1.750	k_2	= 1.375
r	= 1.000	R	= .500

Substituting these values in the equations for the circles and performing all the squares and lumping like terms together as was done in arriving at equation (26) equations (43) and (44) are found.

$$x^2 - 1.376 \times x + y^2 - 3.500 \times y + 2.533844 = 0 \qquad (43)$$
$$x^2 - 3.250 \times x + y^2 - 2.750 \times y + 4.281250 = 0 \qquad (44)$$

Subtracting these two equations as suggested, the equation for line C on Fig. 9 is obtained.

$$1.874 \times x - .750 \times y - 1.745406 = 0 \qquad (45)$$

From this point we may proceed to solve (45) simultaneously with (43) or (44) in the same manner in which equation (35) was solved simultaneously with equation (26). Solving (45) for y we get

$$y = 2.4987 \times x - 2.3272 \qquad (46)$$

Substituting this for y in equation (43) and performing all the indicated operations we get equation (47) in the same manner in which we obtained (37). Equation (47) is:

$$7.243502\, x^2 - 21.751399 \times x + 16.096904 = 0 \qquad (47)$$

If this equation is solved by means of equations (29) and (30), the x coordinates of the points of intersection of the circles in Fig. 2 are determined. Inspection of Fig. 2 indicates that if the circles were continued the x coordinate of the unwanted point of intersection is the larger. Therefore we need only to use equation (30) to calculate the x coordinate of point P_2. Equation (47) yields the following:

$$a = 7.243502;\ b = -21.751399;\ c = 16.096904$$

Upon substituting these values in (30) we obtain

$$x_2 = \frac{21.7514 - \sqrt{6.73153319}}{14.4870} \qquad (48)$$

In calculating the figure under the square root sign the products were carried to twelve decimal places, the subtraction performed and the result contracted to eight places. The square root when computed should be reliable in the third place. Completing the computation of x we get

$$x_2 = \frac{21.7514 - 2.5945}{14.4870} \qquad (49)$$

or

$$x_2 = \frac{19.1569}{14.4870} = 1.3224 \qquad (50)$$

In order to compute the y coordinate of point P_2 on Fig. 2, substitute the value of x_2 from (50) into equation (46) thus

$$y_2 = 2.4987 \times 1.3224 - 2.3272 \qquad (51)$$

or

$$y_2 = .9771 \qquad (52)$$

These values of the coordinates for point P_2 can be checked by substituting in equation (44) and computing the total for the left side. If this total reduces to 0.0001 plus or minus then the values calculated for x_2 and y_2 may be deemed correct within the limits of accuracy given on Fig. 2.

Fig. 2 gives the position of point P_2 as

$$x_2 = 1.321 \pm .001$$
$$y_2 = .977 \pm .001$$

Comparison of these values with those calculated indicates an error in the axial dimension of the point in question while the radial dimension is correct.

Table of Ratios of Cost Reductions, Increased Earnings and Production Increase Required

By Robert Mawson

In a plant operating under an incentive system the management is often at a loss to know what benefits they are receiving from the method of wage payments in the shop. They know the men are receiving more per hour for wages, but does it help the company? The table here given answers this question and can be easily understood.

Taking an example and using the formula: The employes are increasing their earnings 20%; figures show the labor cost has been reduced 10%, but what have the men produced to warrant the increase in wages? 100 plus 20 equals 120. 100 minus 10 equals 90 and 120 divided by 90 equals 133.5. Then 133.5 minus 100 equals 33.5 as the production increase required. In other words the employes are producing 33.5 more work to receive 20% increase in earnings.

PERCENTAGE OF LABOR COST REDUCTION

Per cent increased earnings	Percentage of production increase required	0	5	10	15	20	25	30	35	40	45	50
0		0	5.2	11.	17.6	25.	33.3	42.8	53.8	66.6	81.8	100.
1		1	6.3	12.2	18.8	26.3	34.6	44.2	55.2	68.2	83.6	102.
2		2	7.4	13.3	20.	27.5	36.	45.6	56.8	70.	85.4	104.
3		3	8.5	14.4	21.1	28.7	37.3	47.1	58.5	71.7	87.2	106.
4		4	9.5	15.6	22.4	30.	38.9	48.7	60.	73.2	89.1	108.
5		5	10.5	16.7	23.5	31.2	40.	50.1	61.5	75.	91.7	110.
6		6	11.6	17.8	24.7	32.5	41.3	51.5	63.2	76.7	92.3	112.
7		7	12.6	18.9	25.9	33.7	42.6	52.7	64.5	78.2	94.3	114.
8		8	13.7	20.	27.1	35.	44.	54.3	66.2	80.	96.2	116.
9		9	14.7	21.1	28.2	36.2	45.3	55.7	67.6	81.6	98.	118.
10		10	15.8	22.2	29.4	37.5	46.6	57.2	69.2	83.3	99.7	120.
11		11	16.8	23.3	30.6	38.7	48.2	58.6	70.6	85.1	101.8	122.
12		12	17.9	24.4	31.8	40.	49.5	60.1	72.3	86.7	103.	124.
13		13	18.9	25.6	32.9	41.2	50.4	61.4	73.8	88.3	105.6	126.
14		14	20.	26.7	34.2	42.6	52.	62.8	75.3	90.1	107.	128.
15		15	21.1	27.8	35.5	43.7	53.4	64.5	77.	91.6	109.	130.
16		16	22.1	29.	36.5	45.	54.7	65.6	78.4	93.2	110.	132.
17		17	23.2	30.	37.7	46.3	56.	67.2	80.1	95.2	113.	134.
18		18	24.2	31.2	38.8	47.5	57.3	68.5	81.6	96.7	115.	136.
19		19	25.2	32.3	40.	48.8	58.7	70.1	83.	98.3	116.5	138.
20		20	26.3	33.5	41.3	50.	60.	71.7	84.4	100.	118.2	140.
21		21	27.3	34.5	42.5	51.3	61.5	72.8	86.2	101.6	120.	142.
22		22	28.4	35.7	43.5	52.5	62.7	74.3	87.5	103.3	122.	144.
23		23	29.4	36.7	44.6	53.8	64.	75.7	89.2	105.	123.5	146.
24		24	30.5	37.8	45.7	55.	65.5	77.1	90.5	106.7	125.2	148.
25		25	31.5	38.9	47.2	56.3	66.7	78.5	92.2	108.5	127.	150.

Relation of required production increase to cost reduction and increased earnings

A = % of Labor Cost Reduction
B = % Increased Earnings

Formula—

$$\frac{100 + B}{100 - A} = X$$

C = % of Prod. Increase Req.

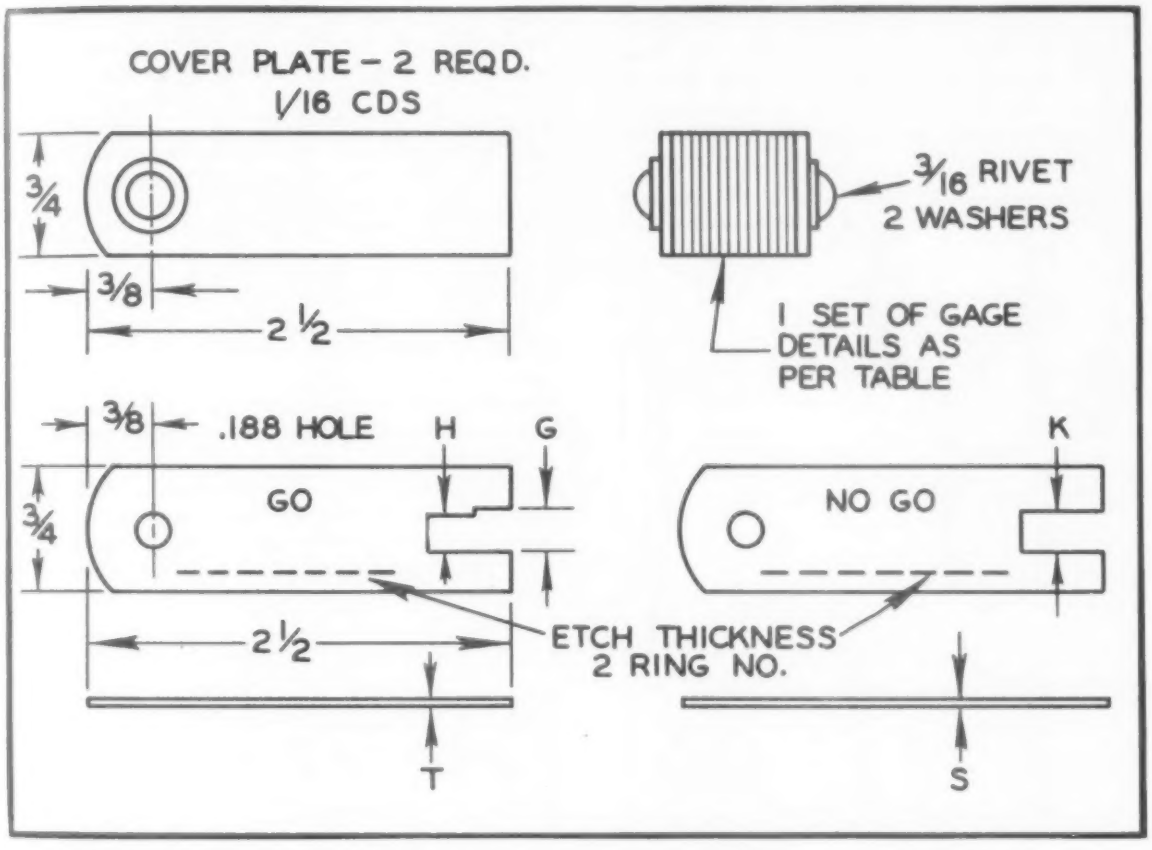
And

$$C = X - 100$$

Slot Gage for Waldes-Kohinoor Snap Rings

By Frank Martindell

TELETYPE CORPORATION



Leaves—Feeler Gage Stock
Gage Tolerance—.0002 in. Grind "G" "H" & "K"

Ring Number	T	H	G	S	K
5133-6	.012	.054	.052	.014	.055
5133-9	.017	.076	.074	.019	.077
5133-12	.017	.097	.095	.019	.098
5133-145	.017	.104	.102	.019	.105
5133-15	.028	.118	.116	.031	.119
5133-18	.028	.149	.147	.031	.150
5133-25	.028	.212	.210	.031	.213
5133-31	.028	.253	.250	.031	.254
5133-37	.039	.306	.303	.042	.307
5133-43	.039	.346	.343	.043	.347
5133-50	.046	.399	.396	.050	.400
5133-62	.046	.488	.485	.050	.489

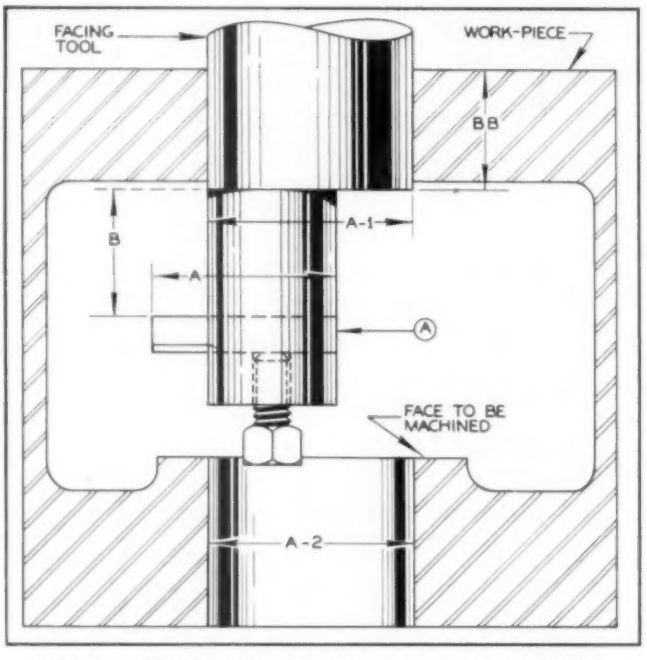
GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Spot Facer for Narrow Places

With two holes of equal diameter in line and the second one to be spotfaced, the cutter must usually be removed each time to get the bar in and out of the first hole. Should there be only a narrow space in which to do this it is an awkward job; however, a type of bar such as illustrated obviates the need for cutter removal.

The body is turned eccentric at the cutter end to a diameter which, together with the amount the cutter protrudes, is a little less than the diameter of the hole. Thus the dimensions A, A1 and A2 are alike. The cutter distance B is slightly more than the metal thickness BB, to enable it to reach through the top hole before the full diameter contacts it.



Inside faces of in-line holes of equal diameter may be spot-faced by means of the eccentric tool shown.

With the machine stopped, and the work loose on the table, the eccentric part A is put through the first hole in the work and is then slid over until the full diameter of A will enter. The work is then tightened up and spotfaced, after which the machine is stopped, the work loosened and moved over in the same way to get the cutter out of the hole.

H. Moore
Hamilton, Ontario

Micrometers on Lathe Hand Wheels

The Gadget Editor

If all manufacturers of lathes were to get together and put a micrometer collar on the apron hand wheel of lathes, a considerable amount of time could be saved by the operators. This collar would prove vital for remachine work, work on shoulders and radii and even while cutting a thread. This would let the operator know how much was removed when facing a piece of stock.

Hugh Maroney, Peoria, Ill.

While Mr. Maroney's suggestion has much to recommend it, there is the consideration that the apron hand wheel moves the carriage laterally through gearing meshing with a rack. Therefore, one turn of the hand wheel moves the carriage a considerable distance and, as a result, lateral feed would be rather coarse as compared with screw feed. Furthermore, the carriage would have to be locked for facing operations, else it would back away from the work, may even gouge into the work in the event in-feed is used.

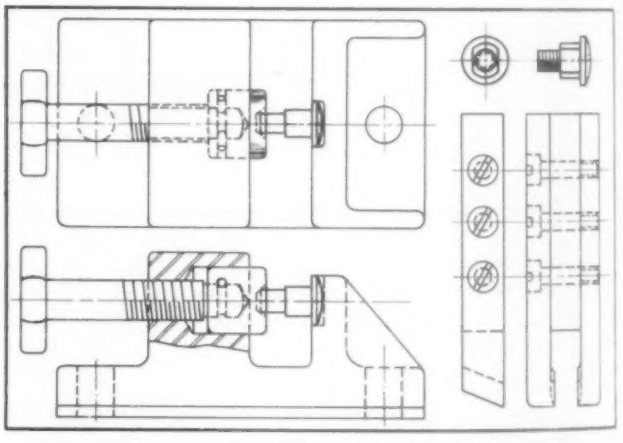
The preferable alternative would be to use micrometer carriage stops, against which the carriage could bear by hand pressure on the wheel. Or, it could be locked if desired. In any event the stops would provide infinitely finer adjustments and would enable the operator to center attention on the work instead of on a micrometer dial. Anyway, many lathes are equipped with a micrometer dial which may be engaged with the lead screw when threading. However, we pass Mr. Maroney's suggestion along to the machine tool builders.

The Gadget Editor

"Milling" on the Punch Press

A manufacturer of small tools is required, among other details, to make a screw which has flats machined on both sides, 11/32 in. across flats, as shown. While these flats must be sufficiently accurate to fit into a broached hole, competition necessitated that the machining be done at the lowest possible cost.

Milling proved too time-consuming, and therefore too costly, so, the job was done on a punch press. The screw is held in a fixture in which the screw head nests into a slot in what may be termed the tool end. The screw is then manually clamped.



The part, shown at upper right, is clamped in the holding fixture shown at right. The flats are shaved by the punch at lower right.

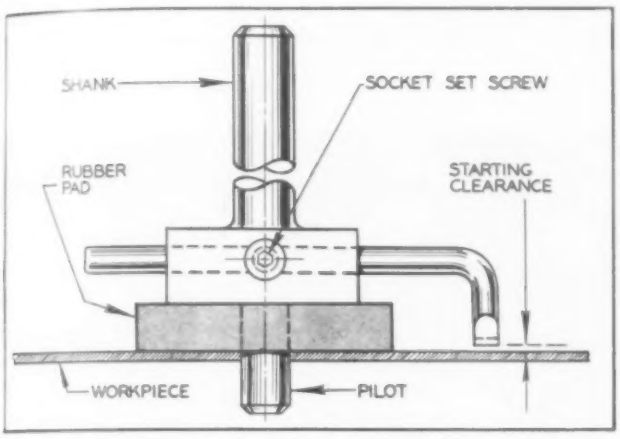
The punch—or shearing tool—is made of three parts consisting of two opposed cutters and an intervening 11/32 in. spacer, all as illustrated to operate, the screw is nested in the slot, the clamp tightened, whereupon the flats are sheared with one stroke of the punch press. The part is then unclamped, and the cycle repeats.

Robert Mawson
Providence, R. I.

The Tool Engineer pays regular page rates for accepted contributions to these pages, with a minimum of $5.00 for each item.

Rubber Pad for Sweep Cutter

When cutting out round blanks from sheet stock with a sweep-type cutter, and the quantity is not enough to warrant cost of punches and dies, the operation can be expedited with reduced hazard by slipping a rubber pad over the pilot, as shown. The pad holds the sheet stock rigid and, by providing a certain spring pressure against downfeed, tends to prevent grabbing as the cutter breaks through.



A rubber pad, interposed between sheet stock and body of a sweep-type cutter, holds the work rigid and tends to prevent grabbing when the cutter breaks through.

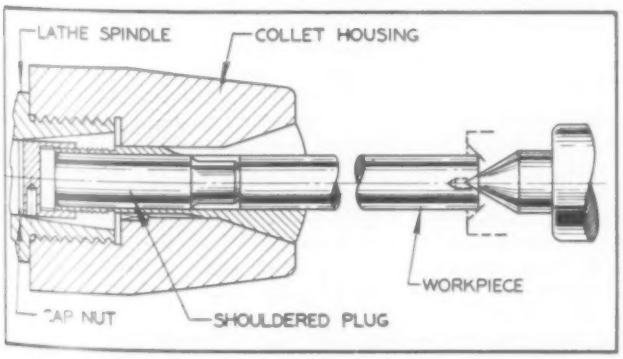
The rubber pad may be from ½ to 1 in. thick and should be fairly flexible—say of the sort used for die cushions. The cutter should be about 1/16 in. from the work at start of cut, with the body of the cutter resting on the rubber pad. The cutting tool itself is of conventional design with pilot made to suit the hole in the stock.

C. G. Spicer
Hamilton Chapter, ASTE

Collet for Gripping Bar Automatically

By the addition of a simple fitting, standard collets can be made to grip bar stock automatically when end thrust is applied to the bar by means of a revolving center. The fitting consists of a plug, inside the collet body, held in place by means of a cap nut. The latter engages the external thread on the collet and replaces the normally used draw-in tube, which can then be dispensed with.

When a bar is inserted in the collet jaws and pushed forward by means of a revolving center, the end in the collet contacts the plug end, thus pushing the collet into its housing and causing it to grip the bar. A revolving center is necessary because constant pressure, sufficient to close the collet jaws, must be applied in order to grip the bar. No difficulty in releasing the collet for removal of the workpiece has been found. The collet is prevented from pulling completely out of the housing by the cap nut, the O.D. of which is larger than the collet shank.



By means of an adapter, bar stock may be gripped in a spring collet by the simple expedient of pushing the bar forward with a revolving center held in the lathe tail stock.

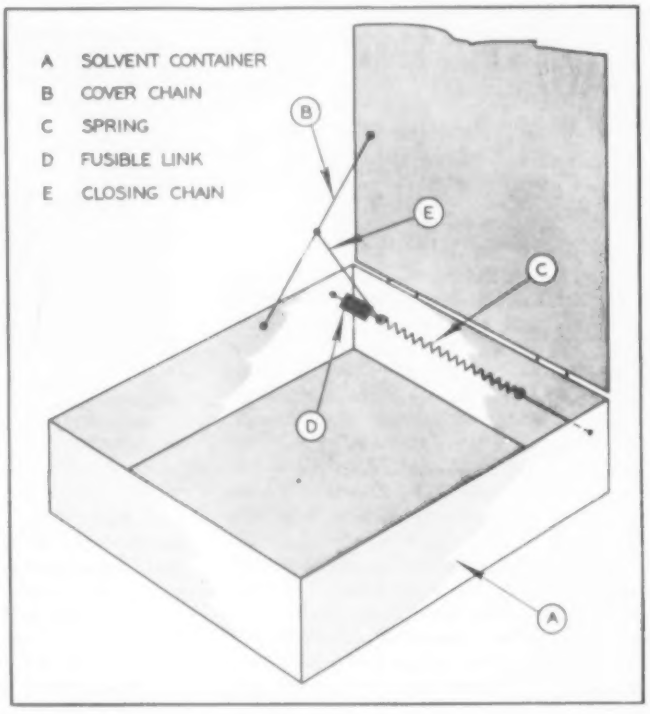
This method of gripping has been used extensively on quantity jobs done on engine lathes and saves time and labor by eliminating use of driving dogs or closing the collet by means of the draw-in tube. A further advantage lies in the fact that the internal plug acts as a positive end locator, so that shoulders may be turned on several workpieces and located by using a carriage stop mounted on the lathe bed. Shoulders thus turned will be a pre-set distance from all shaft ends.

A revolving center—conventional 60 deg or internal Vee—incorporating some form of resilient pressure device is recommended so that sufficient pressure can be applied to the workpiece without overloading the center.

F. E. Riley
London, England

Automatic Container Closer

Along with design of tools, the tool engineer must also consider industrial safety, such as reducing fire hazards in connection with solvent containers. The sketch shows how such a container may be made to close automatically in event of the contents catching fire.



In case of fire, solvent containers may be automatically closed when a fusible link melts. A spring then snaps the cover shut.

In such case, the fusible link D will melt and tension in spring C will cause chain E to pull the cover chain B and close the cover of the container. This will prevent further spread of fire.

J. H. Quatkimeyer
Cincinnati Chapter, ASTE

For the information of our readers, a safety solvent container similar in principle to that shown above is commercially available. This is the Perfection Rinsing Can which, manufactured by the Industrial Products Company, 2820 No. Fourth St, Philadelphia 33, Pa., employs a fusible link that melts and closes the can automatically in event of contents catching fire.

The Gadget Editor

Society Charters Three Chapters

New ASTE Groups in Michigan, Ontario, Iowa Swell Membership, Aid Industry

CONSTANTLY GROWING and reaching into new areas to serve industry, the Society chartered three new chapters between September 21 and October 18—at Ann Arbor, Mich., Galt, Ont., and Des Moines, Iowa (the latter too late to be reported in this issue). This brings the number of ASTE chapter locations to 79.

Ceremonies ushering in the Waterloo Area chapter of 122 charter members took place September 21 at a dinner meeting in Masonic Temple, Ann Arbor.

Glenndon G. Hilge, production engineer at Argus, Inc., and temporary chairman of the group during its organization period, welcomed the 150 members and guests.

A continuation of the spirit of cooperation and enthusiasm shown in the formation of the new group, said Mr. Hilge, will assure a successful chapter.

Credits Membership Men

Naming C. L. Bendle of the National Membership Committee as active in organizing and naming the chapter, Mr. Hilge introduced him and the following members of the local Membership Committee: M. K. Carr, product engineer, Argus, Inc.; L. C. Dietle, tool designer, Falls Spring & Wire Co., Chelsea; E. W. Dolamore, Jr., owner, Engineered Products Co., Chelsea; C. P. Lonskey, broach engineer, American Broach & Machine Co.

E. A. Zander, superintendent, Physicists Research Co.; F. S. Reaume, supervisor, and W. R. Gross, production analysis, Ford Motor Co., Ypsilanti; E. A. Blum, chief engineer, Hoover Ball & Bearing Co.; I. L. Montague, tool designer, Tecumseh Products Co., Tecumseh; George Difenderfer, assistant to general manager, Double A Products Co., Manchester; W. W. Gilbert, associate professor, College of Engineering, University of Michigan; and F. N. Marten, Jr., sales engineer, Buhr Machine Tool Co. R. Lusk of Precision Parts Co. was absent.

Cites Efforts of Organizers

Others recognized by Chairman Hilge were R. D. Black, advertising manager of American Broach & Machine Co., who has headed publicity, Prof. O. W. Boston of the Engineering College, University of Michigan, and a long-time member of Detroit chapter, and fellow officers pro-tem: James A. McCollum, plant superintendent, American Broach & Machine Co., first vice-chairman; David D. Lowber, chief product engineer, Argus, Inc., second vice-chairman; Andrew A. Besford, manager, C. L. Bendle Co., secretary, and Gerald E. Osworth, chief tool designer, Tecumseh Products Co., treasurer.

Top: Officers of the newly-chartered Waterloo Area chapter (Mich.) plan their administration. From left: G. G. Hilge, chairman; J. A. McCollum, first vice-chairman; D. D. Lowber, second vice-chairman; G. E. Osworth, treasurer, and A. A. Besford, secretary. Below: H. E. Conrad (left), executive secretary of the Society, presents the Grand River Valley chapter to H. H. Whitehall, chairman of a new ASTE group at Galt, Ont.

H. E. Conrad, executive secretary from the Detroit headquarters, complimented the officers on their organizational work and the high caliber of men comprising the chapter.

McClellan Presents Charter

Mr. Conrad also presented W. B. McClellan, national secretary of the Society, who conducted an election of officers and presented the charter. Following Secretary McClellan's suggestion, the membership voted unanimously to retain the temporary officers. The national officer administered the oath of office.

Prior to the chartering Mr. McClellan introduced R. W. Ford, national director, L. B. Bellamy, director-elect and national standards chairman, F. W. Wilson, Handbook editor, and S. F. Girard, secretary to the National Standards Committee and secretary pro-tem of the meeting, all of Detroit.

As his first official act, Chairman Hilge presented the technical speaker, Douglas Peden, chief research engineer, Micromatic Hone Corp., Detroit. Mr. Peden's informative talk, "General Considerations of the Honing Process," was supplemented by a film and slides.

Well-Wishers Wire Greetings

During the meeting congratulatory telegrams were read from Harry H. Whitehall, national membership committeeman, of Galt, Ont., and from First Vice-Chairman McCollum who was unable to be present.

* * *

Eighty-five members and guests gathered September 29 at the Canadian General Tower Co., Ltd., Galt, Ont., to witness the inauguration of the Grand River Valley chapter, with 66 charter members.

As acting chairman, Executive Secretary Conrad addressed the assembly, briefly outlining the Society's history and commenting on the efforts of the local group in founding the chapter.

Mr. Conrad then installed the following, elected to head the new chapter during its first year: Harry H. Whitehall,

president and general manager, H. H. Whitehall Ltd., Hespeler, chairman; Harry J. Sehl, owner, Sehl Engineering Co., Kitchener, first vice-chairman; William G. Copp, tool and production engineer, Callander Foundry & Mfg. Co., Ltd., Guelph, second vice-chairman; Joseph D. Strite, superintendent, Bodo Machine & Tool Co., Preston, secretary; and Percy L. Barber, plant superintendent, Onward Mfg. Co., Ltd., Kitchener, treasurer.

Assuming the chair, Mr. Whitehall stressed the necessity of a strong organization within the chapter to carry out the aims of the national Society. In response to a question from the chairman, the membership voted to establish the third Tuesday of the month as the chapter meeting night.

Mr. Conrad read telegrams from President R. B. Douglas of Montreal, Director Ford and National Secretary McClellan, wishing the chapter success and expressing regret that the senders could not be present.

A social hour and refreshments followed adjournment of the meeting.

* * *

Charter members of this chapter include: Frank Lewis, superintendent; A. R. Krueger, toolmaker, and D. E. Mead, toolmaker apprentice, of H. H. Whitehall, Ltd., Hespeler; S. S. Pritchard, plant manager, A. A. McKay, die design, and Eric Oldershaw, section foreman, Firth Brown Tools, Ltd., Galt.

R. P. Weigelt, general superintendent, F. T. Witte, superintendent, and W. E. Schack, foreman, Sehl Engineering Co., Kitchener; John Ward, plant engineer, and J. J. Shaw, tool room foreman, Canadian General Tower Co., Ltd., Galt; L. E. Teat, toolmaker, Greenfield Tap & Die Corp. of Canada, Ltd., Galt.

J. C. Stavert, superintendent, and W. G. Chalk, general foreman, Babcock, Wilcox & Goldie McCulloch, Galt; G. H. Haefling, foreman, Cooke & Denison, Guelph; G. R. Matheson, tool and machine designer, E. G. Hayward, toolroom superintendent, and R. J. Hanna, general foreman, Callander Foundry & Mfg. Co., Ltd., Guelph.

* * *

J. G. Johnstone, chief inspector, and C. C. Hawley, toolmaker, Hi-Speed Tools, Ltd., Galt; R. G. Hinde, plant manager, and J. F. Turner, superintendent, J. A. M. Taylor Tool Co., Galt; D. E. McCready, tool and process engineer, Thomas Baxter, jig and tool draftsman, and C. G. Spicer, foreman, Leland Electric Co. of Canada, Ltd., Guelph.

C. Beingessner, managing partner, B & W Precision Heat Treating Co., Kitchener; S. E. Davis, field representative, Deloro Smelting & Refining Co., Ltd., Deloro; H. G. Winton, plant superintendent, and W. R. Morris, chief engineer, W. A. Kribs Co., Ltd., Hespeler; E. A. Dowler, chief engineer, and W. D. Kincaid, service engineer and designer, B. F. Sturtevant Co., Galt; G. L. Duncan, manager, George L. Duncan & Co., Galt.

R. G. Duncan, president and manager, Stabilex Ltd., Galt; F. K. Gardner, works manager, and F. G. Mahler, draftsman, R. McDougall Co., Ltd., Galt; A. K. Clement, partner, Wellington Welderies, Guelph; H. E. Haskins, vice-president, E. T. Weight, superintendent, and Clarence Henderson, chief inspector, Galt Die & Stamping Co., Ltd., Galt.

Herbert Odd, president, E. P. Hillier, vice-president, and E. W. Chapman, secretary and treasurer, Centerless Grinding, Ltd., Kitchener; F. D. Lewis, toolmaker, Whitehall Machine Tool Co., Galt; W. W. Staubitz, toolroom foreman, Kralinator Products, Preston; Sigurd Anderson, Jr., abrasive technician, Norton Co. of Canada, Ltd., Hamilton.

* * *

A. H. Welker, president and engineer, Welker Mfg. Co., Ltd., Waterloo; J. A. Wunder, owner-manager, Wunder Machine Shop, Kitchener; J. W. Dippel, superintendent, W. C. Snider, assistant superintendent, S. P. Krawczyk, machine and tool designer, C. H. Eaton, draftsman, and G. G. Giesbrecht, toolmaker, Dominion Rubber Co. Machinery Shops, Kitchener.

J. E. Gordon, chief engineer, and W. C. Hunter, supervisor, Joy Mfg. Co. of Canada, Ltd., Galt; Harry Jones, president, Perfect Pipe Wrench Co., Ltd., Galt; E. W. Karn, toolmaker, Waterloo Mfg. Co., Kitchener; Harry Lewis, partner, Galt Metal Products Co., Galt; G. S. Alpine, toolmaker and designer, Stevens Co., Galt; C. J. Bowler, superintendent, and S. H. Monotiuk, tool and die maker, Stamped Enamelled Ware, Ltd., Hespeler; and J. P. Dhandschutter, tool and die maker, Sunshine Waterloo Mfg. Co.

* * *

On the roster of the Waterloo Area (Mich.) chapter are: W. H. Simpson, acting general manager, W. M. Sweeten, manager, Alex Hunter, plant manager, Ivor Evans and A. J. Lobbestael, superintendents, Leland Rendel, production equipment designer, E. L. Steele, and D. L. Peterson, process engineers, F. V. Pernar, W. N. Licorish, Paul Vinson, G. G. Wymer, J. D. Howarth and M. L. Aberle, methods engineers.

W. A. Field, work standards, F. G. Campbell, quality control laboratory, A. L. Ulrich, supervisor, L. B. Hall, assistant supervisor, W. F. Hayden, W. D. Reid and R. H. Smith, general foremen, H. A. Tooman, plant layout technician, B. T. Rorabacher, draftsman, L. D. Dunn, foreman, tool stock, and R. J. Laichalk, apprentice mechanical designer, Ford Motor Co., Ypsilanti.

* * *

D. S. Holt, superintendent, C. A. Anderson and U. H. Rice, methods engineers, Ford Motor Co., Flat Rock; R. E. Donaldson, electrical engineer, and D. E. Larmee, draftsman, Ford Motor Co., Manchester; C. D. Cline, plant superintendent, and C. C. Shaul, draftsman, Ford Motor Co., Brooklyn; and Clark Ralston, chief inspector of the Ford plant at Dundee.

J. W. Podesta, vice-president, C. O. Lofgren and E. L. Bjork, sales engineers, G. A. Deming and L. L. Thayer, service engineers, I. D. Jameson, field engineer, H. R. Holly, broach sales, L. C. Agan, supervisor, A. E. Popp, assistant supervisor, Theodore Perkins, chief tool inspector, L. F. Seeger, tool engineer, F. A. Heddle, broach engineer.

* * *

R. F. Scherer, broach designer, I. K. McAdam, time study engineer, V. F. Steinaway, engineer, C. F. Kern, tool designer, Ralph Perkins, F. J. Below and William Below, foremen, R. W. Edman, toolroom foreman, M. G. Blewett, machine shop foreman, and E. M. Vreeland, tool service, American Broach & Machine Co., Ann Arbor.

R. E. Parker, superintendent, W. T. Price, Jr., project engineer, C. C. Tuthill, draftsman and tool designer, H. C. Bates, toolroom foreman, Argus, Inc., Ann Arbor.

R. F. Sage, assistant to master mechanic, C. R. Fosbender, assistant master mechanic, H. A. Wilson, tool designer, M. L. Ford, tool design, Joseph Rice, process and plant layout, J. L. Springer, time study engineer, Tecumseh Products Co., Tecumseh.

H. E. Sorenson, president, Dexter Machine Products Co., Chelsea; D. E. Woods, owner, Stadium Stamping Co., E. Ann Arbor; I. J. Ziegler, president, G & Z Automatic Products, Jackson; W. B. Seidel, Jr., tool engineer, H. G.

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Pollock, tool designer, and A. H. Bethke, toolroom foreman, Hoover Ball & Bearing Co., Ann Arbor.

G. H. Boots, tool engineer, G. W. Lubahn, experimental die designer, and R. D. Rudd, toolroom leader, Chelsea Spring Co., Chelsea; Archie Anderson, tool and die maker, Pittsfield Products, Inc., Ann Arbor; R. H. Barusch, student, Michigan State Normal School, Ypsilanti; J. W. Arnold, general superintendent, J. H. Calhoun, senior tool engineer, and W. V. Pemberton, tool engineer, Clark Equipment Co., Jackson.

Walter Carr, process engineer, Hayes Industries, Inc., Jackson; H. L. Sanborn, process engineer, and C. W. Wood, assistant estimator, Federal Screw Works, Chelsea; R. S. Little, sales engineer, Burleigh Stocker Machinery Co., Pleasant Ridge; D. L. McBride, Battle Creek, representative, Cleveland Twist Drill Co., Detroit.

* * *

L. W. Thiel, superintendent, Ann Arbor Grinding Co., E. Ann Arbor; E. F. Redies, general manager, R & B Tool Co., Inc., Saline; P. O. Danforth, chief engineer, C. G. Hillegonds, design engineer, V. E. Shannon, process engineer, D. W. Every, toolroom foreman, and L. E. Cooper, machine shop foreman, Physicists Research Co., Ann Arbor.

E. G. Small, vice-president, Dawler Corp., Jackson; B. C. Evans, Jr.; chief engineer, Muskegon Motor Specialties Co., Jackson; J. H. Rohweder, owner, Ottawa Machine Products Co., Tecumseh; F. J. Baldwin, salesman, Standard Tool Co., Detroit; E. F. Krueger, hydraulics engineer, Gene Oleson Corp., Adrian; J. J. Pippinger, manager, Double A Products Co., Manchester.

O. P. Haisch, sales engineer, and Stephen Piatkowski, tool and machine designer, Buhr Machine Tool Co., Ann Arbor; F. E. Gokay, tool engineer, Teer-Wickwire & Co., Jackson; E. W. Zill, production engineer, Precision Parts Co., Ann Arbor; R. J. Pioch, tool engineer, D. W. Leavy and C. R. McArthur, tool designers, Aeroquip Corp., Jackson.

More than 100 members and guests of Erie chapter gather at the General Electric Community Center for dinner and tours of company plants.

Demonstrates High Speed Lathes in Films

New York City—A film lecture, "Latest Applications of Recently Developed Lathes and Their Attachments," held the attention of approximately 250 members at Greater New York chapter's first dinner meeting of the season at Hotel New Yorker, September 12. It was presented by S. A. Brandenburg, vice-president in charge of sales for the Monarch Machine Tool Co. of Sidney, Ohio.

The first film showed the electronically-controlled Speedi-Matic lathe with nine control stations on a panel in full view of the operator. Designed to handle small screw machine work in lots of 25 to 500 or more pieces, the machine is claimed to be one of the latest and most efficient in its field.

The Mona-Matic lathe was featured in the other motion picture. This machine is equipped with an air gage tracer template controlled with duo cycle and constant feed. It also has a template or master workpiece control with automatic feed change.

The presiding officer, Chairman Julius Schron, Immediate Past Chairman William Lentz and the Executive Committee have arranged an outstanding program for the entire season.

In observance of the chapter's tenth anniversary year, the Entertainment Committee has planned a dinner and dance at the Tavern-on-the-Green in Central Park.

Williams Joins Ford

Detroit, Mich.—Earle D. Williams, formerly master mechanic at Cameron Iron Works, Houston, Texas, has accepted a position as manager of manufacturing engineering with the Lincoln-Mercury Div. of Ford Motor Co.

The Detroit chapter member was earlier associated with U. S. Rubber Co., New York City, as manager of industrial engineering; the Carrier Corp., Syracuse, N. Y., as assistant works manager in charge of engineering; and with General Motors Corp. and Packard Motor Car Co. of Detroit.

G. E. Host for Tours Of Product, Tool Plants

Erie, Pa.—The Erie Works of General Electric Co. entertained Erie chapter September 12 at the G. E. Community Center.

Following dinner, served to 110 members and guests, Chairman Archie Weingard introduced J. L. Knight, manager of engineering of the Household Refrigerator Division of General Electric. Mr. Knight narrated the development and manufacturing of electric refrigerators from the first models to those now on the assembly lines.

Mr. Knight then presented Stanley Sullivan of the Personnel Division, who outlined a well planned tour of the Refrigerator and the Locomotive and Car Equipment Tool divisions.

Escorted by company guides the engineers were led through the buildings in small groups. Of especial interest was the manufacture of parts for freezing units. In the second building of the refrigerator plant, cabinets are made and the product assembled.

Among guests were: H. O. Frumpfeller, manager of Manufacturing Locomotive and Car Equipment Division; Bert Miller, assistant works manager; Bert Hall, supervisor of locomotive and car equipment tool room; Henry Disco, superintendent of refrigerator cabinet manufacturing; Mr. Rystoge, superintendent of Refrigerator Unit Division; and Mr. Traphagan, supervisor of personnel. ASTE members were present from Warren and Meadville.

In a business meeting prior to the tour, Walter Cebelinski, public relations chairman, was elected second vice-chairman to succeed John Van Kampen who has left the chapter area to become sales manager of the Wisconsin Drill Head Co.

Named Sales Manager

Montreal, Que.—A. B. Chevrier, public relations chairman of Montreal chapter, has been appointed Canadian sales manager of the Oster Manufacturing Co. of Cleveland, Ohio.

Mr. Chevrier was formerly associated with Upton Bradeen and James, Ltd.

Worcester chapter observed its tenth anniversary recently with a Past Chairman's Night. Speakers' table guests from left are: C. J. Lindegren, Raymond Cole and Herman Libby, past chairmen, C. D. Schofield, incumbent chairman, Carroll Morse, first vice-chairman, Albert Warman and Charles Monigle, past chairmen, Ralph Rawling, technical speaker and past chairman, Bernard Szarek, treasurer, Thomas Bradford, and chairmen, Roland Ljungquist (entertainment), John Rotchford (public relations)

ASTE to Sponsor Standards for Tool Materials

Detroit, Mich.—Through a long-range program enlisting the service and know-how of Society members, ASTE has actively entered the field of standardization.

This announcement by L. B. Bellamy, ASTE national standards chairman, followed the postwar organizational meeting of the ASTE-sponsored American Standards Association Sectional Committee B52, Classification of Materials for Tools, Fixtures and Gages, September 23, at the Engineering Society of Detroit. Attendance at the meeting represented a cross-section of national industry.

Officers elected are: Chairman, A. M. Swigert, vice-president, Universal Products Co., Dearborn, Mich.; vice-chairman, D. J. Giles, vice-president, Latrobe Electric Steel Co., Latrobe, Pa.; and secretary, R. C. Peterson, owner, Peterson Engineering Co., Toledo, Ohio. S. F. Girard, secretary of the ASTE National Standards Committee, served as recording secretary.

Dr. John Gaillard of the ASA conducted the election and spoke informatively on the function of a sectional committee under ASA procedure.

Giles Hears Steering Committee

To facilitate initiation of committee work, Chairman Swigert appointed Mr. Giles to serve as Steering Committee chairman. Others named to the committee are: E. E. Griffiths, consulting manufacturing engineer, Parent and International Co., Headquarters Manufacturing Div., Westinghouse Electric Corp., Pittsburgh, Pa.; Mason Britton, president, Metal Cutting Tool Institute, New York City, Mr. Peterson and Mr. Swigert.

This group is to formulate a work program, clarify or revise the present scope of the sectional committee, and select the first standardization project.

Following a meeting of the Steering Committee at Pittsburgh in October, subcommittees will be appointed. In all probability, Mr. Bellamy reports, the first undertaking will be the standardization of high speed steels, since considerable work has been done in this field by the automotive industry, as well as by smaller industries, and technical organizations.

Developing standards for the fields assigned to the B52 Committee, Mr. Bellamy added, will require years of work, much of which will be accomplished by ASTE members serving on the many sub-committees to be set up.

Participating standardization groups were represented at the meeting as follows: Society of Automotive Engineers, L. A. Danse, supervisor, materials and processes, General Motors Corp., Detroit; National Bureau of Standards, T. G. Digges, metallurgist, U. S. Department of Commerce, Washington, D. C.; American Standards Association, Telephone Group, J. W. Howerton, metallurgist, Western Electric Co., Chicago, Ill.; National Machine Tool Builders' Association, F. O. Hoagland, master mechanic, Pratt & Whitney, Div. Niles-Bement-Pond Co., W. Hartford, Conn.; American Iron and Steel Institute, M. E. Cummings, assistant to the president, Crucible Steel Co., New York City, and Mr. Giles; Metal Cutting Tool Institute, Mr. Britton; Pressed Metal Institute, Mr. Peterson; and American Society for Metals, Dr. Taylor Lyman, editor, Metals Handbook, Cleveland, Ohio.

ASTE representatives included: G. S. Wilcox, Jr., assistant factory manager, Plymouth Div., Chrysler Corp., Detroit; William Moreland, production manager, Greenlee Bros. & Co., Rockford, Ill.; O. E. Harvey, Ohio district manager, Modern Corp., Detroit; W. H. Smila, master mechanic, Plymouth Div., Chrysler Corp., Detroit; and W. A. Thomas, superintendent, tool engineering, Ford Motor Co. of Canada, Windsor, Ont.

Soderling Explains Uses Of Gaging in Production

Seattle, Wash.—H. F. Soderling of the Soderling Tool Co., representative of Sheffield Corp., Dayton, Ohio, spoke before 42 members and guests of Seattle chapter, September 13, on uses of the Precisionaire gage, especially for production runs.

Mr. Soderling's slide illustrated lecture was augmented by Oliver Kernodle of Welkerson Valve, Inc., who spoke on moisture and dirt exhausting valves for air tools such as the Precisionaire gage. A demonstration with compressed air proved the effectiveness of the valves.

Former Chairmen Feted On Tenth Anniversary

Worcester, Mass.—With a dinner meeting honoring past chairmen, Worcester chapter observed its tenth anniversary, September 13, at Putnam & Thurston's Restaurant.

C. John Lindegren, Raymond A. Cole, Herman G. Libby, Albert T. Warman, Charles W. Monigle and Ralph E. Rawling, former chapter heads, were present and spoke briefly on the founding and history of the Society in Worcester and New England.

The technical feature, "Do's and Don't's of Gear Design," was presented by Past Chairman Rawling, who is owner and manager of the Rawling Gear Works, Worcester.

Illustrating with color slides and diagrams, Mr. Rawling discussed common errors in design, incorrect gears, gear cutting machines, and new ideas in gear manufacture.

Chairman Carl D. Schofield presided at the meeting attended by approximately 75 members.

Binghamton Group Told Mechanics of Television

Binghamton, N. Y.—Binghamton members had a peep into the future of television when R. M. Bruce, district representative, electronic department, General Electric Co., Syracuse, N. Y., addressed their September 7 meeting at Saxon's Fish Fry.

After tracing the progress of video, Mr. Bruce discussed projected uses to benefit business and the general public. A sound film, explaining the mechanics of television, followed his talk. The ensuing discussion helped clear up questions in the minds of the engineers concerning this complex subject.

* * *

E. J. Reitler of Firth-Sterling Steel Co. talked on the use of carbide die steel and its application in blanking and piercing dies at a dinner meeting, October 5, in the American Legion Hall at Vestal. Following his talk, Mr. Reitler conducted an open discussion.

Dean Erlenmeyer, chairman, introduced the speaker to the 100 members and friends present. Donald Ellis, chapter treasurer, led after-dinner singing.

ASTE Show, Short Cut to Lower Production Costs

A FIELD that would take sales engineers experienced in applying the latest cost-cutting equipment months to cover —if enough of them were available—can be contacted in one week at the Tool Engineer's Exposition at Philadelphia, Pa., April 10-14.

This, according to R. B. Douglas, ASTE president, is the aim of the Society in bringing to thousands of industrial executives a gigantic display of efficient production machinery, tools, processes and services in the Convention Hall and Commercial Museum of the nation's birthplace.

As Mr. Douglas pointed out, it is only through showing countless small suppliers to big manufacturers how they can cut costs that the price of the ultimate product can be reduced.

In the automotive industry, Mr. Douglas cited, there are some 2000 vehicle, parts, and accessory manufacturers. Less than 500 of these firms have more than 100 employees. These 2000 manufacturers are in turn supplied by about 25,000 other companies, most of them relatively small.

Economies in Small Firms Vital

"What these medium-sized and small companies do in the way of cost-cutting," said President Douglas, "will largely determine what the final vehicle producers can accomplish in that direction. We can't just cut at the top today. We have to cut all the way down the line.

"Informative advertising by makers of modern equipment can do a big job. But it takes manpower to answer all the questions—where the equipment can be used, where it will save money. We can't wait to train enough experienced sales engineers to do the job. We have to find short cuts and substitutes.

"We believe an industrial exposition such as we are planning can go far in supplying the answer. All our plans for this show are built on the idea of helping suppliers talk directly to as many prospective buyers as possible—all in one week. We know that tens of thousands of production men want to see exhibits and demonstrations of such time- and money-saving manufacturing equipment. Getting customers and suppliers together can save them months of effort and expense."

As an indication of industry's eager response to this opportunity, Mr. Douglas quoted, nearly 150 exhibitors (at press time) have already requested space in the Society's 1950 spring show. And inquiries are coming in daily from companies who have not exhibited previously. The new location at Philadelphia is attracting many Eastern firms who have never participated in ASTE shows.

National advertising of the big exposition begins in the November issues of trade publications in the metal working field. Publicity furnished foreign ambassadors has been acknowledged and forwarded to the trade and public press in their respective countries. This is part of the Society's effort to help rehabilitate industries in war-ravaged lands.

Literature and detailed information concerning the exposition are available from the American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21.

Cleveland Sees Operation Of Detroit Tank Arsenal

Cleveland, Ohio—About 75 Cleveland ASTE'ers and their wives visited Detroit September 23 to inspect the Detroit Arsenal.

The wide range of operations employed in manufacturing and reconditioning tanks provided points of interest for everyone in the party.

M. O. Cox, Detroit chapter chairman, welcomed the Ohio group and escorted them to the new Society building. After viewing the National Headquarters facilities, the Cleveland chapter officers were dinner guests of Detroit chapter.

The dinner party includes Glenn A. Hier, chairman; Andrew B. Clark, secretary; and Mrs. Clark, and Daniel Campbell, treasurer, of Cleveland chapter. W. B. McClellan, national secretary; and Mrs. McClellan, L. B. Bellamy, national standards chairman and his commitee; John D. Anderson, second vice-chairman; and Mrs. Anderson, Mrs. M. O. Cox, assistant secretary; and Chairman Cox, of Detroit chapter.

Sports, Clambake Feature Twin States Outing

Springfield, Vt.—Some 60 members and guests of Twin States chapter enjoyed a day of sports contests, topped off with a New England clambake, September 17, at the Windsor Country Club. The bivalve feast was prepared by the club under the direction of H. H. Ranney, chairman for the annual outing.

Main event was a golf tournament with winners carrying off prizes as follows: first low gross, Francis Thorley, New Bedford, Mass., 74; second low gross, Robert Brown, Windsor, 76; non-member, low gross, S. Trafford Hicks, Walpole, N.H., 78; left-hand player, Edward Duclos, Springfield, 95; blind bogie, Robert Smith, New Bedford.

Nearest pin on sixth hole, Robert Metzger, Chester; nearest pin on seventh hole, Clifford Howe, Windsor; longest drive, L. Bushor; most No. 3's, Stephen Ellison; most No. 5's, Donald Laundry and E. J. Gebow; most No. 7's, David Armstrong; most No. 9's, Dan Parker, Sr.; putting contest, Robert Brown.

Donald Percival of Worcester, Mass., triumphed as tennis champ and Harold Noyes of Claremont, N.H., topped the horseshoe pitchers.

A soft ball game between Wally Emerson's Red Sox and Don Laundry's Blue Sox climaxed the sports events. After five innings of vigorous slugging and haranguing with Umpire B. L. Thomas, the Red Sox emerged winners, 12 to 4.

Following supper on the clubhouse porch, Chapter Chairman L. M. Davis awarded prizes for the day's events, assisted by Mr. Ranney.

Visitors were welcomed from Springfield, Windsor and Perkinsville, Vt.; Claremont, Concord, Manchester and Walpole, N.H.; New Bedford and Worcester, Mass.

Burton, Seitz Advanced

Philadelphia, Pa.—E. O. Burton, secretary of the Philadelphia ASTE chapter, has been promoted to chief furniture engineer at Philco Corp. Stanley Seitz, another local member, has been advanced to the position of tool engineer for the same company, according to a recent announcement.

Cleveland chapter officers are guests of Detroit chapter at a dinner party following a tour which the Ohio chapter made through the Detroit Arsenal. Around the table from left are: J. D. Anderson, second vice-chairman, Detroit chapter, and Mrs. Anderson, Daniel Campbell, Cleveland treasurer, Glenn Hier, Cleveland chairman, M. O. Cox, Detroit chairman, A. B. Clark, Cleveland secretary, and Mrs. Clark, Mrs. Cox, assistant secretary, Detroit, W. B. McClellan, national secretary, and Mrs. McClellan. L. B. Bellamy, national standards chairman, and his committee joined the group after the photograph was made.

Tool engineering goes back to the beginning of recorded history, Louis Ruthenburg, board chairman of Servel, Inc., reminds Evansville chapter. At left are W. V. Stippler, first vice-chairman, and W. P. Schneider, chairman, and (right) H. J. Ferguson, program chairman, and W. E. Baker, vice-president in charge of manufacturing at Servel.

Predicts Wider Use Of Barrel Finishing

Newark, N. J.—Northern New Jersey chapter resumed activities for the fall and winter season with a discussion of "Barrel Finishing of Aircraft Parts" at a meeting September 13 at Hotel Robert Treat.

The speaker, Joseph Wingate of Eclipse-Pioneer Division of Bendix Aviation Corp., pointed out the progress made in this art and predicted a bright future for it. He described finishes obtainable, applications, speed of the barrel, and work load. Nearly 400 members and guests heard Mr. Wingate's lecture.

During the meeting it was announced that R. Hitchcock of Westinghouse Electric Corp. would address the chapter's year-end Education Night on December 13.

Approximately 400 turned out for the chapter's annual picnic held in the summer. Quoits and baseball were the main events on the sports program.

Former Chapter Chairmen Honored at Boston Dinner

Boston, Mass.—Past Chairman's Night marked Boston chapter's first meeting of the season. It was held September 8 in the New England Mutual Hall, with Chairman Joseph P. Crosby presiding.

Past chairmen seated at the speakers' table included: John Geddes, William Young, J. B. Savits, Henry Richards, Alfred Forbes, John Ryneska and Warren Ames. Approximately 140 members and guests were present for the dinner and program.

George A. Roberts, chief metallurgist of Vanadium-Alloys Steel Co., was the technical speaker. Opening his lecture, "Tooling for Stainless," with a brief review of stainless steel development, Mr. Roberts continued with a discussion of austenitic types of stainless and their uses.

In conclusion he explained in detail the physical properties and machining characteristics of these steels.

Seth Barraclough, a member, entertained during the dinner hour with accordion selections and later played for group singing.

In a color film, "Strange Gods of India," the audience followed the travels of a motor caravan through that country.

Ruthenburg Lauds T.E.'s Contribution to Industry

Evansville, Ind.—Servel, Inc. was host to Evansville chapter at the opening meeting of the fall season, held September 12 in the Servel cafeteria.

Louis Ruthenburg, board chairman of Servel, spoke on "The Tool Engineer's Contribution to Industry." Since the beginning of recorded history, Mr. Ruthenburg stated, the tool engineer has gained prominence. The inventor of the first wheel was a tool engineer in his own right. Although usually not an inventor, the present tool engineer makes his contribution to industry by conceiving ideas for more efficient tooling and production methods.

Harry Ferguson, superintendent of the company's Tool Division, was in charge of arrangements for the dinner, vocal entertainment by the Servel Octet and Mr. Ruthenburg's address.

Special guests were Henry J. Appel, superintendent of the Tool Division of Seeger Refrigerator Co., and W. E. Baker, vice-president in charge of manufacturing at Servel.

Elected Vice-President

Providence, R. I.—At a recent directors' meeting Kenneth E. Sutton, manager of manufacturing for Monowatt, Inc., was elected vice-president in charge of manufacturing, the company has announced.

A member of Northern New Jersey chapter, ASTE, Mr. Sutton was plant manager at Wright Aeronautical Corp., Paterson, N. J., before joining Monowatt last year.

Textile Machinery Plant Host to Providence

Providence, R. I.—Universal Winding Co. of Cranston was host to Little Rhody chapter for a dinner meeting and plant tour, September 8.

Following dinner, served in the company dining room to 60 members and guests, Chairman Delbert Krahnke introduced John Coxe, director of industrial relations, James Cruickshank, superintendent, Joseph Connelly, assistant to the vice-president in charge of production, and other company representatives, all of whom welcomed the tool engineers to their plant.

During a business meeting the members voted to change the chapter meeting night from the third Wednesday to the first Thursday of the month.

J. R. Hackett, assistant director of the extension division, Professor Hoye, dean of mechanical engineering, and S. C. Roberts, field representative, all representing the Rhode Island State College, reported on progress and plans for the second year of the tool design program offered by the college extension service in cooperation with Little Rhody chapter.

A copy of the "Tool Engineers Handbook," exhibited during the meeting, commanded high interest. For many members it was the first opportunity to see the new manual.

Following the meeting the gathering separated into small groups for a tour of the Universal company, one of the oldest makers of textile machinery in the country.

The route led through the engineering department, display room, conveyor assembly lines, manufacturing and processing departments.

Nashville Entertains Applicants at Steak Fry

Nashville, Tenn.—Four prospects submitting applications for membership were dinner guests of Nashville chapter at a steak fry held September 23 at Wright's Lake. Attendance at the first fall gathering included 25 members as well as the guests.

During a business meeting J. W. Gipson was elected secretary to fill the office left vacant by the recent death of John Oglesby. Mr. Oglesby succumbed to a heart attack while on a business and pleasure trip to Germany.

Guests of honor at Boston's Past Chairman Night are, from left: Alfred Forbes, J. B. Savits, Henry Richards, J. P. Crosby (incumbent chairman), Warren Ames, John Ryneska, John Geddes and William Young.

Wrong Thinking of Industry, Labor Keeps Costs Up

Philadelphia, Pa.—Management and labor both have misconceptions that hamper potential productivity and add to the cost of countless products, Tell Berna, general manager of the National Machine Tool Builders' Association, informed an Executives' Night audience at Philadelphia chapter, September 15.

Speaking on "Investment in Prosperity," before 250 industrial executives, tool engineers, representatives of local colleges, and guests, Mr. Berna explained what is keeping these two factors in industry from coordinating their efforts.

Management, asserted Mr. Berna, is laboring under the delusion that a machine tool in good running order is still a good tool. Actually, plants in this country are filled with machine tools of war and prewar vintage, long since obsoleted by postwar models that reduce operating costs. He urged industrialists to modernize their plants and regain the adventurous spirit that has made this country great.

E. O. Burton, secretary, Philadelphia chapter, and C. W. Hamilton of the Sheffield Foundation, Dayton, Ohio, present scholarship awards to H. W. Maiocco, G. A. Schmidt and Charles Fees at the chapter's recent Executives' Night. Tell Berna (inset), general manager, National Machine Tool Builders' Association, and R. B. Douglas (seated), ASTE president, were guest speakers at the function.

Mechanization Increases Jobs

Labor on the other hand, he pointed out, is obsessed with the fallacy that new and better machines cause unemployment. By failing to get out of new models the full measure of productivity that has been built into them, said Mr. Berna, labor is not only defeating its own long-range objectives, but is adding an inexcusable burden to the consuming public. History has proved that employment and wages rise in direct proportion to mechanization, he said.

Complimenting the Society on its work, Mr. Berna stated that much of the progress in machine tools has resulted from the prodding and criticism of tool engineers. Increasing output per man-hour through less operator fatigue and effort has become a trend in machine analysis, he declared.

The dinner speaker, ASTE President R. B. Douglas of Montreal, commented on the strength of industrial America as observed on his train trip to Philadelphia. The importance of men, he stressed, should not be forgotten in this machine age. Developing tool engineers and students is necessary to advance accurate and economical production.

The tool engineer, Mr. Douglas continued, must not only have technical knowledge, but must also be a good economist and manager. Although this involves great responsibility, it is rewarded with respect that balances the effort expended.

President Douglas commended the chapter on the strides it has made in developing tool engineering curricula in local colleges.

Following Mr. Douglas' speech, E. O. Burton, Philadelphia chapter secretary, and C. W. Hamilton of the Sheffield Foundation, Dayton, Ohio, presented chapter scholarships to H. W. Maiocco, University of Pennsylvania, $500; G. A. Schmidt, Drexel Institute of Technology, $500; and Charles Fees, Drexel Institute of Technology, $125. An additional award of $75 for a student of Spring Garden Institute is to be announced. Mr. Burton outlined the procedure used in selecting the winning students.

These scholarships have been made possible through efforts of chapter members, the Philco Corp. and Sheffield Foundation. Awards are made to deserving students screened by the schools and accepted by the chapter's scholarship foundation.

T. J. Donovan, Jr., described tool engineering courses available at Spring Garden Institute. These courses, said Mr. Donovan, originated through Philadelphia chapter.

During dinner Chairman Emil Kr... man, the presiding officer, introduced the following executive guests: J. R. Weave... vice-president, Baldwin Locomotive Works; D. H. Renfrew, general superintendent, and R. W. Suman, chief engineer, Link-Belt Co.; Prof. J. S. Moore... house, dean, Villanova College; W. A. Morley, chairman, Philadelphia chapter, American Foundrymen's Association.

Represent Industry, Education

John Lawrence, plant manager, SKF Industries; Louis Millon, works manager, General Motors Ternstedt Div.; W. A. Williams, chief engineer, American Pulley Co.; J. B. Parks, president, Spring Garden Institute; Prof. L. N. Gulick, dean, University of Pennsylvania; Col. G. W. Blackington, consulting engineer, The Budd Co.; E. C. Schultz, master mechanic, Spicer Mfg. Co.; Theodore Wiedemann, vice-president, Wiedemann Machine Co.

A. W. Barndt, works manager, Heintz Mfg. Co.; U. W. Fischer, vice-president, Schutte & Koerting Co.; E. K. Spring, chairman, Philadelphia chapter, American Society for Metals; H. S. Harris, executive secretary, Engineers Club of Philadelphia.

Frank Chaplin, assistant director of laboratories, Franklin Institute; John Benetz, president, Tool and Die Association; J. P. Bernard, Sheffield Foundation.

Society Visitors

Other ASTE chapters were represented by: B. C. Stambaugh, vice-chairman, Central Pennsylvania; John Epprecht, chairman, Northern New Jersey; Andrew Jones, chairman, Baltimore; and Julius Schoen, chairman, Greater New York.

Chaplain R. E. Miller of the U. S. Navy offered the invocation before dinner.

Slide Lecture Clarifies Die Design Procedure

Louisville, Ky.—Stanley R. Cope, president of the Acme School of Design and of Colfax Engineering Co., South Bend, Ind., was guest speaker at the first fall meeting of Louisville chapter, held September 14 at the Kentucky Hotel. Sixty members and guests attended the dinner meeting presided over by Chairman N. H. Booker.

Humorist as well as engineer, Mr. Cope was entertaining and helpful in his discussion of "Die Design." His engineering background and wartime government service on shell drawing and other projects make him well versed in this field.

Augmenting his talk with about 90 slides, Mr. Cope discussed each in detail. His lecture included many new designs, information on which previously had been sketchy and incomplete.

The influx of press and die work in the Louisville area within the past few years made the subject of especial interest to the engineers. At the conclusion of his talk Mr. Cope answered questions from the members, concerning die design problems.

Chicago Sees Modern Foundry Operations in Film

Chicago, Ill.—Chicago tool engineers had the opportunity of viewing the second public showing of a motion picture, "From Iron Ore to Motive Power." The film was exhibited by Robert W. Gardner, general foreman of foundry quality control, Ford Motor Co., Dearborn, Mich., as the technical feature of a meeting held September 13 at the Western Society of Engineers headquarters.

The opening sequence showed the buildings of the highly mechanized foundry where Ford, Mercury and Lincoln castings are made. Every detail, from receiving the raw materials to completion of castings, has been carefully planned to reduce manual handling and cost and to improve quality.

Molding sand as well as core sand starts its journey from the fourth floor and progresses through reclaiming units, mixing, and blending machines with manually controlled handling equipment. All processes are controlled by careful inspection.

Reinforced with wire when necessary, the cores are routed through drying ovens. Baked cores are then carefully assembled into complete units, dipped in a finish coating and spun to remove the excess.

Ladle Fills 120 Molds an Hour

Molds are similarly prepared and the cores carefully inserted, using alignment gages to assure the required wall thickness. The molds are placed on a conveyor with a filling basin attached. A ladle car moving on a track parallel to the conveyor and at the same speed, pours iron of a predetermined formula into the molds at the rate of 120 per hour.

Cooling conveyors carry the molds to the shakeout machines where molds and cores are broken up. Most of the sand is reclaimed for reprocessing. After hand trimming, the castings are ready for machining.

Iron for the castings is just as precisely controlled. Pig iron, made in the blast furnace from raw ore, and iron from the cupola are run into a mixing furnace where cast iron of the proper formula and temperature is produced.

The mixing furnace is tapped into ladle cars for pouring into molds. The entire process is so integrated and mechanized that little is left to chance, the Ford film demonstrated.

Prior to Mr. Gardner's presentation, Frank Martindell, a member of the ASTE Handbook Committee, talked briefly on the Society's new "Tool Engineers Handbook." The committee, Mr. Martindell stated, would welcome any constructive criticism.

Explains Simple Method For Timing Operations

Elmira, N. Y.—A simplified method has been found for timing an operation previous to production, according to J. L. Schwab, manager, New England Division, Methods Engineering Council, Bridgeport, Conn. This method, developed by measuring the average time necessary to make basic movements in performing certain operations, was the subject of Mr. Schwab's lecture, October 3, before a dinner meeting of Elmira chapter at Mark Twain Hotel.

At the close of his talk, the speaker answered a number of questions from the unusually large chapter audience.

* * *

On September 12 Harold P. Granger, Eastern regional manager, The Bellows Co., described "Production Miracles Through Controlled Air Power."

Air powered devices, he added, can be used to create automatic types of machines, reducing machining costs and original investment.

Mr. Granger was introduced by W. L. Buell, field engineer for his firm.

The meeting introduced a program in which participating local machine tool companies will supply packets of engineering data for members and guests. Barker, Rose & Kimball furnished the packets for this occasion.

Hails Gadgets as Vital To American Progress

San Francisco, Calif.—"Gadgets Are My Business," Don L. Davis of the Gadget-of-the-Month Club, told Golden Gate members at a meeting September 22 at Del Mar Restaurant.

Each month, according to Mr. Davis, club members receive some new "gadget" approved by the research staff of the organization. To win such approval a gadget must pass extensive trials, tests and sales possibilities. A gadget he defined as "any new product that is a laborsaving device."

"America's greatest development," the speaker stated, "is due to gadgets." He listed the three important steps in the progress of a gadget as: (1) when it is new it is a "gadget"; when it reaches a production and distribution of 100,000, it is a "standard"; (3) when it supplies a market of 100 million, it becomes a "necessity."

Encouraging the development of new ideas and patents, Mr. Davis impressed those present with the important part that tool engineers play in the successful development and production of a new item. There are more inventions in the United States, he observed, than in any other land because men are free to think and create.

Attended by an overflow crowd, the meeting opened with dinner and a short business session.

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M. O. Cox (right), Detroit chapter chairman, congratulates a panel of hydraulics experts on the excellence of the symposium they presented to the chapter. From left: James Robinson of Vickers, Inc., Don Morrell, Ford Motor Co., Otto Mueller, Mueller Engineering Co., and Robert Mitchell, General Motors Corp.

Frank Finlayson of the Hotpoint Div. of General Electric Co., Ontario, Calif., discusses the development of electric irons before a shirtsleeve session of Los Angeles chapter during recent heat wave.

Nearly 1000 Jam Detroit Hydraulics Symposium

Detroit, Mich.—More than 900 members and guests of Detroit chapter crowded into the Engineering Society of Detroit auditorium, September 8, to hear an outstanding symposium on Hydraulics.

A panel of four speakers divided into two groups presented the program. Robert Mitchell, production engineer, General Motors Corp., and executive secretary of the Joint Industry Conference, and Don Morrell, supervisor of standards and control applications, Ford Motor Co., represented the users of hydraulics.

Speaking for manufacturers of hydraulic machinery were James Robinson, chief engineer of Vickers, Inc., representing the National Machine Tool Builders' Association, and Otto Mueller, owner and chief engineer of Mueller Engineering Co.

J. I. C. Standards Benefits

Mr. Mitchell reviewed the concept and development of the J.I.C. hydraulic standards. "How the Standardization Program Is Benefiting Users of Hydraulics Equipment" was explained in Mr. Morrell's talk. With slides he showed how faulty installations have been eliminated and down time has been reduced through greater efficiency and understanding of hydraulics, obtained with J.I.C. standards.

Needs of the user as well as problems of the machine builder have been taken into consideration in the standards, Mr. Robinson told the Detroit engineers.

In describing "New Developments in High Pressure Piercing Equipment," Mr. Mueller showed motion pictures of equipment working with hydraulic pressures up to 7000 lb psi.

These pressures, he predicted, will be increased to 10,000 lb psi in the near future. This will permit more work with smaller equipment.

Following their formal talks, the speakers served as a board of experts, answering questions from the floor relative to hydraulic machinery.

The chapter invites members of other chapters to attend its meetings held the second Thursday of the month at the Rackham Building.

Golf and Dinner Party Open Pittsburgh Season

Pittsburgh, Pa.—Pittsburgh chapter opened its 1949-50 season with an informal dinner meeting at the Edgewood Country Club. The meeting followed the chapter's annual fall golf party held in the afternoon.

After dinner in the clubhouse G. C. Wood, first vice-chairman, introduced J. E. Thornton, special agent in charge of FBI, Pittsburgh Division. In outlining the work of the Federal Bureau of Investigation, Mr. Thornton cited several case histories illustrative of fields covered by this agency.

W. W. Walter, entertainment chairman, presented a trio who rendered musical selections for the 120 members and guests in attendance.

Prior to the speaking and entertainment program, Frank T. Boyd, chairman, presided over a brief business meeting. Fred Hennig, membership chairman, discussed the chapter's outlook for the year; Gardner Young, national program committeeman, urged attendance at the semi-annual meeting in Montreal; and J. M. Lloyd, program chairman, reported on the activity of his committee.

Mid-Hudson Members Teach Chapter Courses

Poughkeepsie, N. Y.—A series of evening courses on tool engineering subjects is being offered by Mid-Hudson chapter in conjunction with the Poughkeepsie Board of Education.

The classes meet for two hours and minutes once a week through the school year. Chapter members who are specialists in their respective fields will instruct the students.

The courses are: Jig and Fixture Design—fundamentals and construction as practiced in industry; Shop Mathematics—practical problems relating to leverage, screw threads, simple and compound gearing, ratios, cutting speeds and feeds. Methods Engineering—basic principles of time and motion study.

Tours, Films Supplement Lectures

Precision Measurements—use, care and adjustment of the principal measuring instruments found in modern shop practice; Heat Treatment—principles and practices of heat treatment of ferrous metals. Auxiliary information will include metallurgy, metallography and production heat treatment methods.

Automatic Screw Machine Theory—characteristic features, setup, operation and production possibilities of automatic screw machines. Class work will be supplemented by slides, films and shop tours; Punch Press Cutting and Forming Dies—basic principles of punch press tools used in making sheet metal parts. Blanking, piercing, shaving, extruding, embossing, forming, drawing and coining operations will be explained.

Production Welding, Soldering and Brazing—methods and tools involved in electric spot and projection welding, electric arc welding, soft and silver soldering and copper-hydrogen brazing.

Engineering Head Details Electric Iron Production

Los Angeles, Calif.—Tooling and production of one of the housewife's most used tools formed the technical subject at a meeting of Los Angeles chapter, September 8, in Rodger Young Auditorium.

In lecturing on "Development of Electric Irons," Frank Finlayson, managing engineer of the Hotpoint Division of General Electric Co. at Ontario, also filled in the background of the California plant.

Announcement was made of a forthcoming chapter tour through the Long Beach plant of Douglas Aircraft Co., Inc. This plant is now getting into production on the huge C124 cargo transport for the U. S. Air Force.

Gerald Stronks, chapter chairman, presided at the meeting.

Cole Leaves Pope

Worcester, Mass.—Raymond A. Cole of Worcester chapter has resigned as vice-president of Pope Machinery Corp., Haverhill. Mr. Cole's future plans are indefinite.

Major F. R. Sperl (inset) tells Rockford members lack of faith leads to fear, while addressing a meeting in the rustic, YMCA log cabin lodge.

Likens Fear of Unknown To Bomb Destruction

Rockford, Ill.—Fear of the unknown can be as devastating as an atomic weapon, according to Major Ferdinand R. Sperl, a Rockford hotel manager and former officer in the O.S.S. Speaking before 75 Rockford chapter members attending a dinner meeting September 7 in the log cabin YMCA lodge on the Rock River, Major Sperl discussed "The Psychology of Fear."

Delving further into his subject, Major Sperl stated that this fear of the unknown is unseen and unheard, but is highly contagious, spreads rapidly, and is effective months after being planted. Through the ages tyrants such as Ghenghis Khan, Napoleon, Hitler and the Soviets have bred fear through cruelty and oppression. This same fear of the unknown is employed in questioning prisoners of war, he added.

Mental Laziness

In this push button age, the major pointed out, too many people are letting others do their thinking for them—accepting opinions of radio and press instead of forming their own.

It all boils down to a lack of faith, said the Swiss-born U. S. army officer. Faith is character which in turn is the result of training and habit. Half a century ago when people had home chores to do, they developed honesty, initiative and self-reliance. This self-reliance has made America what it is today and we owe it to our pioneer forefathers to preserve this precious heritage.

Universal military training was advocated by the speaker to inculcate self-reliance in young Americans.

At the conclusion of Major Sperl's talk, two films were shown—one, depicting the extraction of magnesium from sea water, its uses and possibilities; the other, a technicolor sound cartoon.

As coffee speaker Frank Martindell, of Chicago chapter and the ASTE Handbook committee, spoke briefly on problems involved in producing the Society's tool engineering manual.

Coming Next Month

Report of **Montreal Convention.**

Romulus Student Heads Tri-State ASTE Group

Angola, Ind.—William Bowman of Romulus, Mich., was elected chairman of Tri-State College junior division of Fort Wayne chapter at a recent meeting of the student group. Mr. Bowman is studying administrative mechanical engineering at Tri-State.

Elected to serve with him were: Robert A. Fesser, an administrative mechanical engineering student from Jackson, Mich., first vice-chairman; Robert F. Sawyer, St. Ignace, Mich., second vice-chairman; Richard L. Ashville, Angola, secretary; and John E. Atkinson, Coldwater, Mich., treasurer. The latter three officers are majoring in mechanical engineering. Professor Minard F. Rose is faculty advisor for the group.

During their six months' administration the new officers will endeavor to present a full program of meetings.

Others present at the election meeting included Emil W. Mellin, past chairman; John F. Davis, chairman; and R. G. Peterson, secretary, all of the parent Fort Wayne chapter.

At the previous meeting Stanley F. Cope, president of Acme School of Die Design in South Bend, spoke to about 100 members and friends of the Tri-State group. Using a large selection of slides, he outlined a third-semester die design course offered at the South Bend school.

The Tri-State College ASTE group invites Society members passing through Angola to stop at the college for a tour of the campus. Tri-State is located on U. S. Routes 20 and 27.

Kansas T. E.'s Open Season with Stag

Wichita, Kans.—One hundred and ten members and guests of Wichita chapter resumed fall meetings, September 14, with a stag dinner at Elkhorn Lodge.

Responsible for the enjoyable event were: William F. Grabendike, chairman; Leigh Icke, immediate past chairman, and "chef" for the occasion, Emanuel, Pitsch and Hazen Dool, first and second vice-chairmen, who provided the entertainment, and Roy O. White, membership chairman, who handled ticket sales.

Attendance included Carl Burnham and M. M. Ross, the chapter's first and second chairmen, respectively.

News Films Demonstrate Variable Speed Drives

St. Catharines, Ont.—Dramatic sound films of the crash of the Hindenburg in 1937 and the destruction of the Tacoma bridge in 1942 were viewed by members of Niagara District chapter during their September 1 dinner meeting.

G. E. Andrews, district representative for U. S. Electric Motors, Inc. of Los Angeles, presented two motion pictures, "Specification Syncrogear" and "Rhapsody in Speeds." The sequences of the zeppelin and bridge disasters were shown as examples of documentary news photography, the detailed action of which would have been lost to the world without the development of infinitely variable speed drives.

In addition to the manufacture of infinitely variable speed motors, the second film demonstrated interesting applications. These included adjustably speeded power conveyors for fruit sorting, milk bottling, steel rolling mills, soap flake manufacturing and wood pulp conveying plants.

Mr. Andrews also showed graphs delineating the fluctuation of factory employees' energy throughout the day. On conveyor lines, he pointed out, an adjustable speed regulator is necessary to prevent over-fatiguing workers when their energy is lowest.

At the end of the film, John Marsh of the J. R. Marsh Co., St. Catharines, who assisted Mr. Andrews with the lecture, quoted recent applications in Ontario.

Norman Coleman, chapter chairman, and W. L. Sandham, past chairman, spoke at the conclusion of the lecture and thanked Mr. Andrews and Mr. Marsh for their informative program.

Situations Wanted

ENGINEERING EXECUTIVE — 43, experienced in supervising production in various types of machine and machine tool manufacturing. Background also includes sales, sales engineering and field service work. Received technical education in Great Britain and U. S. Available in Cleveland area. For further information write to Box 187, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

TOOL ENGINEER—10 years with tool and die concerns as chief engineer on special machines—customer proposals, quotations, supervision of design, checking final drawings. Background includes extensive experience in tool design. Please address replies to Box 185, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

TOOL ENGINEER—36, with five years' experience in tool and machine design. Shop background in developing and proving special tools. Steady, family man looking for permanent employment. Good mathematician. Box 186, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

Metal Spinning Gains Wider Uses – Lengbridge

Hamilton, Ont.—John W. Lengbridge, product engineer for Aluminum Goods, Ltd., Toronto, and immediate past chairman of Toronto chapter, gave the first technical talk of the fall season at a dinner meeting of 57 Hamilton chapter members and guests held in Fisher's Hotel, September 9.

In discussing "Metal Spinning," Mr. Lengbridge reviewed the background of the process since its introduction in Canada approximately a century ago. Then it was used chiefly for spinning precious metals and pewter; today it has almost unlimited applications.

Metal spinning gained further impetus during the late World War when it was found economical and practical in forming such parts as helicopter shields, engine cowls and tank heads.

Tougher and thicker metals, larger diameters and more intricate shapes lend themselves to spinning than were considered possible 20 years ago, the speaker emphasized.

Aided by lantern slides Mr. Lengbridge described methods, tools and machines used in metal spinning. A sound film shown at the conclusion of his talk further illustrated the technique of this art.

John Dick assisted the speaker with projectors for slides and film. George Churchill, vice-chairman, introduced Mr. Lengbridge and Gordon Hall, immediate past chairman, thanked him.

At the conclusion of the session, Mr. Lengbridge demonstrated with exhibits of spun metal work in answering questions and assisting members with individual problems.

During a business meeting preceding the technical session, Chairman George Gilmour announced a fall dance, a stag night, and evening courses in tool design to be sponsored by the chapter. The latter, scheduled at Hamilton and Brantford high schools, were explained in detail by Clarence E. Bulmer, education chairman.

Paper and Metal Plants Show Blank Book Making

Springfield, Mass.—From rags to ledger paper to finished blank book, Springfield chapter saw the making of record books during an afternoon visit September 12 to National Blank Book Co. at Holyoke. The group also observed the manufacture of writing paper at Whiting Paper Co.

Following dinner at the Yankee Pedlar, films were shown of the chapter's clambake and reports were given on the successful summer event.

Robert E. Barrett, Jr., president and treasurer of the Holyoke Water Power Co., was the principal speaker, giving an illustrated lecture on the history of navigation and water power development on the Connecticut River since 1790.

The 61 members present included Past President Frank W. Curtis, four past chairmen of the chapter and two visitors from Boston chapter.

John W. Lengbridge of Aluminum Goods, Ltd., Toronto, describes for his fellow ASTE members at Hamilton the process and applications of metal spinning.

Murray Gives Pointers On Lathe Selection

Utica, N. Y.—"Fundamentals of Turret Lathe Practice" was the subject of an illustrated lecture by E. L. Murray, sales promotion manager of Warner & Swasey Co., at the first autumn technical meeting of Mohawk Valley chapter, September 27.

Approximately 60 members and guests attended the meeting in the new quarters at the Moose Home, 1312 Genesee Street. E. J. Masucci, chairman, presided and introduced the speaker.

Mr. Murray used diagrammatic and picture slides to depict the applications described. He emphasized the following points for determining the selection of a turret lathe for one or more applications: (1) stroke; (2) tool support overhang; (3) power feeds; (4) head stock; (5) speed; (6) power; (7) tool clearance; and (8) machine handling time.

The comprehensive lecture included a discussion of carbide tool applications and slides demonstrating tooling methods for machining a cap screw and a special nut.

In describing the use of standard and special tools, the speaker urged an analysis to determine whether to buy or make such tools. He showed a slide of a sample cost analysis.

A question and answer period followed.

Taylor Explains Tooling For Thermoplastics

Grand Rapids, Mich.—For their first meeting of the fall season, 36 Western Michigan chapter members and guests heard N. C. Taylor, service manager for the Tennessee Eastman Corp. speak, September 13, on "Tooling for Thermoplastic Materials."

As background for his talk Mr. Taylor showed a company film, "The Story of Tenite." Samples of complicated plastic products on display included a molded, one-piece football helmet and an all-plastic gun stock.

The meeting adjourned after an interesting discussion period. The chapter invites visitors to Grand Rapids to attend its meetings, held the second Monday of the month at 7:00 p.m. in the Rowe Hotel.

Stewart Tells Canadians Economies of Fluid Power

Montreal, Que.—Advantages of air and fluid operated hydraulic systems, manual and power master control valves were presented to Montreal members by H. L. Stewart, assistant sales manager of Logansport Machine Co., Logansport, Ind. Mr. Stewart spoke September 8 on "Fluid Power in Action" before 92 members and guests attending a chapter meeting at Canadian Legion Hall.

The automatic hydraulic system with remote control, he said, eliminates lag in operation, has a safety factor in the automatic shutoff, and lessens operator fatigue. Fluid power, he summarized, saves time, effort and motion, reduces maintenance costs and gives flexibility of application.

Slide illustrations included one showing how power chucking of irregular shaped parts is five times faster than hand chucking.

G. A. Rogers, national program committeeman, introduced the speaker and George Foster thanked him.

After the meeting, refreshments were served through the courtesy of Rudel Machinery Co., sponsor of the program.

Demonstrates Broaching With Films and Samples

Fort Wayne, Ind.—A film lecture, "Broaching," was the technical feature at the first fall meeting of Fort Wayne chapter, September 14.

K. N. Macomber, chief engineer of Lapointe Machine Tool Co., Hudson, Mass., was the speaker, augmenting his presentation with two sound motion pictures, "Surface Broaching" and "Tooling for Jet Propulsion." After a question period, the audience examined broached parts on display.

How young people are opening new fields with great financial success was related by Donnelly P. McDonald, president and treasurer of the Peoples Trust and Savings Co. of Fort Wayne, in a coffee talk preceding the session.

Mr. McDonald cited local examples in the founding and rapid expansion of the Wayne Knitting Mills and Central Soya Co.

Through the application of atomic power to mechanized industry, the speaker predicted, great prosperity and better living are in store for America.

Members of the Allied School of Mechanical Trades section of Chicago chapter give close attention to a machine operation during a recent tour of Scully-Jones & Co. plant.

Sees Human Relations As Tool of Industry

Windsor, Ont.—Tool engineers and industrial relations men have much in common. They both play important roles in industrial production. They speak the same shop language. There are striking similarities in the techniques they employ to solve their daily problems.

These comparisons between two dissimilar phases of manufacturing were made by Wallace H. Clark, director of industrial relations for Ford Motor Co. of Canada, Ltd., Windsor. Addressing an overflow audience of Windsor chapter members, September 12, in the Prince Edward Hotel, Mr. Clark discussed "Human Relations in Industry."

As mechanization has progressed, Mr. Clark explained, working forces have increased and human problems have multiplied. So the industrial relations division assists the manufacturing division with its human relations problems.

Urges More Coordination

There must be ever-increasing understanding and cooperation between the tool engineer and the industrial relations man. Unless the human and mechanical factors are in harmony, the modern factory cannot be efficient and fully productive.

Environment, equipment and surroundings must all be good to make the worker content. Among social problems facing the nation today, the speaker declared, none is more vital than the establishment of better relationships between workers and employers.

If we are to have the harmonious influences which make possible full production in industry, the automotive executive emphasized, we must have strong and wise management by men who are not so preoccupied with their immediate tasks that they lack an awareness of all the problems of running a business.

While we have a responsibility to keep our companies strong, said Mr. Clark, we have on the other hand a responsibility to provide good working environments for our staffs.

Build Management from Ranks

One of the most important phases of modern management, he believes, is to constantly strengthen and invigorate it by advancing competent men from the ranks. The worker must be equipped with training to give him the ability and desire to climb step by step up the ladder of opportunity.

In conclusion the speaker stressed: "Whether or not we are able to produce today and tomorrow will depend, not upon outside sources; not upon government; not upon mechanical processes; not upon philosophies, but upon the simple human relationships that exist from day to day and from hour to hour between individuals of management and the individuals responsible to them."

Coming Meetings

CENTRAL PENNSYLVANIA—November 17. Speaker: F. M. Howell, Aluminum Company of America, Pittsburgh, Pa. Subject: "Mechanical Testing." December 15. Speaker: F. O. Hoagland, Pratt & Whitney, W. Hartford, Conn. Subject: "American Standards in Machine Shop Practice with Emphasis on Surface Roughness."

CHICAGO—November 18, Western Society of Engineers, 84 E. Randolph. Speaker: L. B. Bellamy, ASTE member of Standards Council, ASA, and Adam Gabriel, Sr., ASTE representative on ASA Committee B-46, Classification of Surface Qualities, and Committee B-5, Jig Bushings. Subject: "Standards and the Tool Engineer." December 13, 7:00 p.m., Harmony Hall, 4359 W. Thomas. Speakers: W. B. Scott, works manager, and Charles Blahna, engineer in charge of quality control, Motorola Corp. Subject: "Operation of Motorola Production Organization" and "Television in Everyday Language." Followed by tour of Television Div. of Motorola.

CLEVELAND—November 11, Cleveland Engineering Society. Speaker: R. R. Rhodehamel, vice-president, National Acme Co. Subject: "Fifty Years of Progress with the Master Tools of Industry." Coffee speaker: A. C. Body, patent counsel. December 9. Annual Christmas Party, Rainbow Room, Hotel Carter.

ELMIRA—December 5, 7:00 p.m., Mark Twain Hotel. Speaker: W. H. Spence, sales director, Brown & Sharpe, Providence, R. I. Subject: "Automatic Screw Machines and Tooling."

HARTFORD — December. Joint meeting with Society of Quality Control.

INDIANAPOLIS—December 1, 7:00 p.m., The Athenaeum. Annual Ladies Night. Speaker: Anauta, the Eskimo woman from Baffin Island. Subject: "Life and Habits of Our Neighbors of the Far North." Music and dancing.

PHILADELPHIA—April 10-14, Convention Hall and Commercial Museum. Tool Engineer's Exposition and 18th ASTE Annual Meeting.

SPRINGFIELD (Mass.) — November 14, joint meeting with the Quality Control Engineering Group of Springfield and Engineering Society of Western Massachusetts. Dinner, 6:30 p.m., in plant cafeteria. Meeting in auditorium. Subjects: "Freon and Its Working Characteristics" and "Atomic Energy."

TORONTO—December 7. Speaker: S. E. Casson, Acme Machine & Tools, Ltd., Subject: "Basic Principles in Tooling Automatic Screw Machines."

Students See Manufacture Of High Production Tools

Chicago, Ill.—Approximately 50 members of the Allied School of Mechanical Trades section of Chicago chapter studied the manufacture of high production tools in a recent visit to Scully-Jones & Co.

George Safranski, Charles Gline and Steve Novak of the Scully-Jones staff escorted the students through the plant in three groups.

Of particular interest were the multiple spindle machines demonstrating how production parts can be made with ease, accuracy and speed. Informal question bees centered around several machines.

Methods of drive and tolerances important to production brought many questions from the boys. They crowded around the centerless grinders, amazed at the accuracy of these machines. Each department described its operation and function so that the visitors could understand how it coordinates in the overall production process.

Enthusiasm ran high as the students gathered for the final talks by Mr. Lockrem, Mr. Skoglund and Mr. Better.

R. E. Lingen, chairman of the student section, expressed the appreciation of his fellow members for the valuable experience gained in the shop tour.

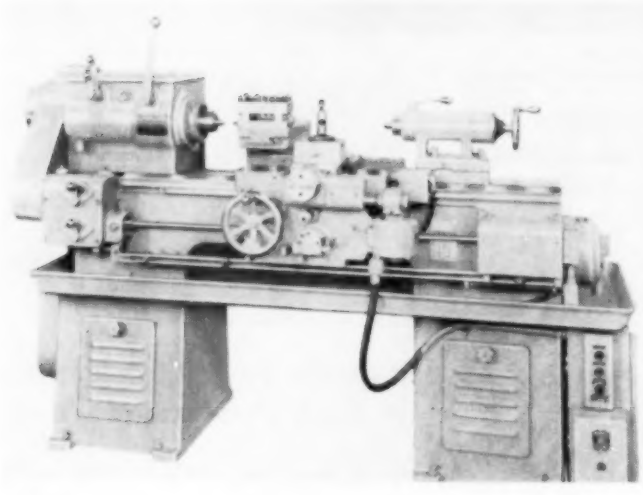
Shows Power Transfer From Biblical Times

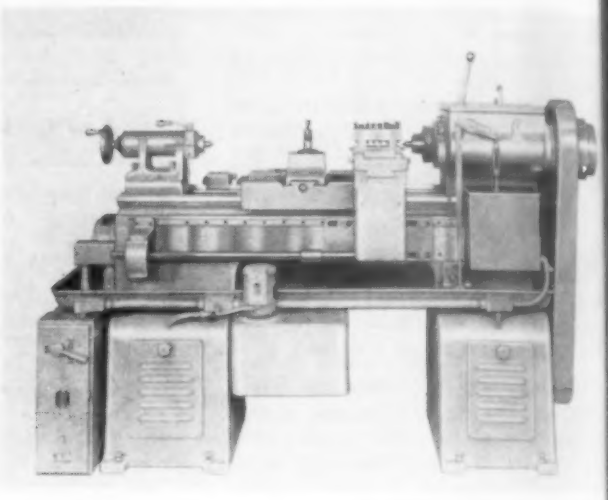
Madison, Wis.—September dinner meeting of Madison chapter was highlighted by an address on the "History of Power Transmission."

W. A. Williams, chief engineer of the American Pulley Co., Philadelphia, was the speaker at this session held at Heidelberg Hofbrau on the 9th. With slides Mr. Williams dramatized the progress of power transmission from 300 B.C.

TOOLS OF TODAY

LeBlond Introduces the Clipper Automatic Lathe

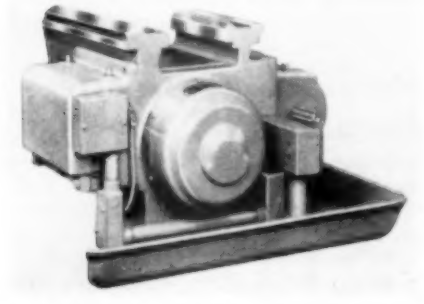




At left, front view of the 13 in. LeBlond "Clipper" automatic high speed manufacturing lathe, here shown with normal speed geared headstock. Two other optional heads are also available, choice being optional. At right, rear view of the Clipper, showing the automatic back facing attachment, coolant pump and tank, and the spindle clutch operating solenoid.

Ease of operation and simplicity of setting up for any given job are cited among major advantages provided by the Clipper, an automatic high speed manufacturing lathe being introduced by the R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio. For average turning and facing jobs there are no cams to change. Starting point is determined by the position of a micro-length limiting switch on the bed, and length of cut is determined by the setting of a positive automatic length stop on the trip bar.

Once set up for automatic cycle, the machine runs through a complete cycle —plunge to depth, turn, tool relief and rapid traverse to starting position. Operator attention is thus reduced to a minimum so that, as pointed out by the builder, one operator can tend several machines where nature of work so permits. The Clipper can also be used as a semi-automatic or manually operated lathe.

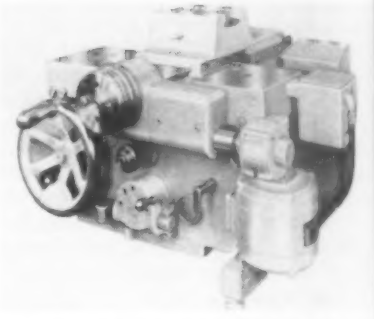


The traverse control mechanism, consisting of traverse reverse control and motor which return apron and carriage to starting position. The bed ways are steel, hardened and ground.

The apron is completely automatic. A cross feed mechanism moves the tool in and out electrically, with depth of cut pre-set by means of a positive, adjustable stop located on the bridge of the carriage. Longitudinal feed toward the headstock is engaged by starting the machine. Tools feed to depth angularly, and turning is then controlled by the regular feed mechanism.

At the end of the cut, the apron engages a positive length stop which actuates a time delay switch. In the brief interval, tools are relieved and the rapid traverse mechanism returns the apron rapidly to starting position. At this point, the apron contacts a micro-length return limiting switch which disconnects the entire circuit and stops the machine with tools in position for loading.

Three types of headstocks are offered, with choice optional. A regular antifriction head, designed for medium spindle speeds, has two ranges of six selective speeds each; 68 to 400 rpm or 102 to 600 rpm. A high speed antifriction head also has two ranges with six selective speeds—200 to 1200 and 250 to 1500 rpm. A high speed motor head has the motor built into the headstock, the stator being bolted to the casting and the rotor pressed onto the spindle. This headstock is furnished with one of nine spindle speed combinations varying from 250 to 3600 rpm.



This view shows the completely automatic apron of the Clipper. The cross feed mechanism moves the tool in and out electrically. A positive adjustable stop, located on the carriage bridge, may be set for any desired depth of cut. At the end of the automatic cycle, the apron contacts a micro-length return limiting switch which disconnects the entire circuit and stops the machine with tools in loading position.

Swing over the bed and carriage wings is 14⅞ in. The bed of the Clipper is fitted with hardened and ground steel bed ways front and rear. Available as added equipment is an automatic back facing attachment, coordinated with the apron to work in the regular automatic cycle. It may be positioned anywhere on the bed, power coming from the feed rod through the driving mechanism. Pick-off gears vary the length of cross travel in relation to length of feed carriage.

While the foregoing provides the highlights of this lathe, complete specifications may be had in LeBlond Bulletin ARP-1, available from the manufacturer on request. T-11-1

Simplified Hydraulic Press

A simplified design of Hydraulic Press has been developed by engineers of the E. W. Bliss Co., 1420 Hastings St., Toledo 7, Ohio. The first of the series, a 650-ton single action press is representative of the standards which apply to both single action and double action types.

The engineering changes, designed to provide benefits to press users in lower initial and maintenance costs, smoother and quieter operation, and increased production, have been achieved as follows: A simplified circuit and the use of a dual flow pumping system; a major reduction in the amount of piping and valves; unit design of frame, cylinder, and slide; prestressed tie rod frame; four adjustable flat type Meehanite gibs with removable wear strips on uprights; foot valve directly connected to cylinder; no interconnecting piping; and an open type prefill valve.

The pump design permits reversing of oil flow and provides a controlled gravity descent with smooth starting and stopping as well as smooth release of pressure at the end of the pressure stroke. No shocks or surges. Front uprights are straight to facilitate truck loading. **T-11-2**

Saddle for Cable and Hose

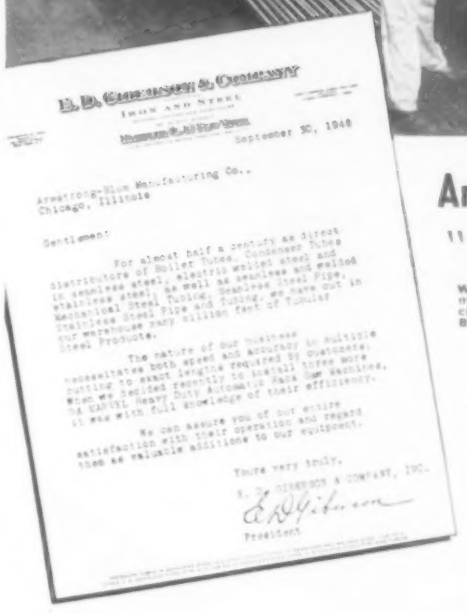
Osborn Mfg. Co., Warsaw, Ind., announces a Saddle for use with electrically, hydraulically or air operated portable tools such as welder guns or riveters. Electrical cable, water, oil and air hose, or a combination of those, rest on the saddle which is curved to prevent localized beading which, eventually, results in failure.

The saddle, which is made from light aluminum alloy, may be used in combination with suspension balancers and provides better maneuverability of tools as a result of nesting cable and/or hose in a close group. **T-11-3**

Leader Pin Oilers

The Acro Metal Stamping Co., 338 E. Reservoir Ave., Milwaukee 12, Wis., announces automatic lubrication of die set leader pins. The lubricators are Oil Wells which slip over leader pins, which may be easily adjusted to proper height and tightened. After filling, no other adjustment is necessary.

The oilers are interchangeable to any die set having same diameter pin and require no attention other than filling. They are especially adaptable for high speed long runs since, regardless of press speed, the oilers provide a constant cushion of oil between pin and bushing. Hand oiling is eliminated, die life is prolonged and production increased. The oilers are available in a range of sizes to suit various leader pin diameters. **T-11-4**



E. D. Giberson & Company
IRON AND STEEL
September 30, 1948

Armstrong-Blum Manufacturing Co.,
Chicago, Illinois

Gentlemen:

For almost half a century as direct distributors of Shelby Tubes, Condenser Tubes in seamless steel, electric welded steel and stainless steel, Electric Welded and Welded Vertical Steel Tubing, Seamless Steel Pipe, Stainless Steel Pipe and Tubing, we have put in our warehouse many million feet of tubular steel products.

The nature of our business necessitates both speed and accuracy in multiple cutting to exact lengths required by customers. Thus we decided recently to install three more machines, the latest Heavy Duty Automatic Hack Saws, in addition to the eight Hack Saws of various makes we already had in operation. We have found that your MARVEL No. 9A Automatic Hack Saw is entirely satisfactory in every respect, and we wish full knowledge of their efficiency.

We can assure you of our entire satisfaction with their operation and regard them as valuable additions to our equipment.

Yours very truly,

E. D. GIBERSON & COMPANY, INC.

President

Another Tubing Warehouse "Goes MARVEL"

Warehouses that are not equipped with proper sawing machines find that the cutting of steel tubing (especially the stainless types) is a difficult and costly job. But E. D. Giberson & Company, New York, have cut off millions of feet of all types and sizes of steel tubing to accurate lengths, economically and without difficulty, due to the fact that they have long been properly equipped with MARVEL SAWS. And because they have found MARVEL SAWS so trouble-free, so reliable, so economical to operate and so universally suited to all their cutting-off jobs, they have recently added this row of three new MARVEL No. 9A Automatic Hack Saws. With this additional equipment, they have expanded their facilities and can more promptly serve their fast-growing list of satisfied customers with steel tubing of all types and sizes, "cut to customer's specified lengths".

The local MARVEL Field Engineer will be glad to study your range of cutting-off work—whether it be in pipe, structural shapes, bars, or the toughest and largest alloy billets—and will then make recommendations on how you can improve your cutting-off operations to reduce costs and increase man-hour output.

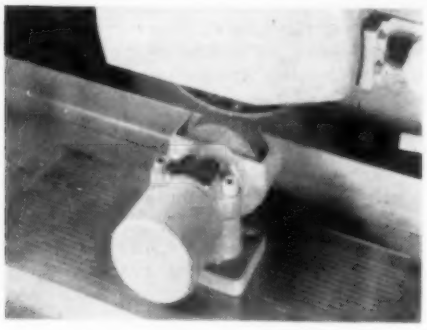
Just write us on your letterhead: "Without cost or obligation on our part, send your local Field Engineer to look over our cutting-off operations".

MARVEL Metal Cutting SAWS
Better Machines—Better Blades

ARMSTRONG BLUM MFG. COMPANY
"The Hacksaw People"
5700 West Bloomingdale Avenue Chicago 30, Illinois

Wheel Truing Device

The Norton Brake-Controlled Truing Device, now for sale by the Norton Company, New Bond St., Worcester 6, Mass., is designed for rapid, precision truing of newly mounted wheels as well as for repeated truing. Because metal bonded and vitrified bonded diamond wheels in particular present truing problems due to their high wear resistance, this device should be of considerable interest to industry.



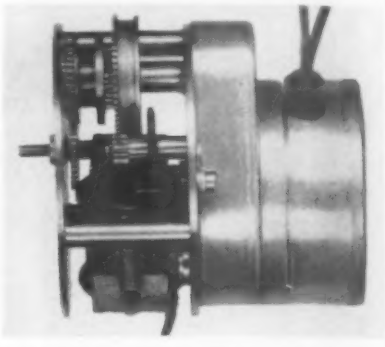
The device is small, compact and, because it is self contained, simple to set up and operate. Driven by the diamond wheel to be trued, it obviates a motor with its upkeep and "nuisance wires". This feature further obviates the need for reducing wheel speed during the truing cycle.

The Norton device is designed for truing diamond wheels of all bond types with the exception of resinoid bonded finer than 200 grit, which can be trued with Crystolon sticks held in a vise and passed across the face of the wheel.

T-11-5

Small Synchronous Motor

The R. W. Cramer Co., Inc., Centerbrook, Conn., announce Type SXC Synchronous Motor, with a differential clutch mechanism, is designed to meet the needs of many timing, recording, indicating and switching applications requiring an accurate reset operation. Compact and small — approximately 2-1/16 x 3 in.—with 39 output speeds available from 15 rpm to ¼ rpd, it delivers 30 in/ozs of torgue at 1 rpm.



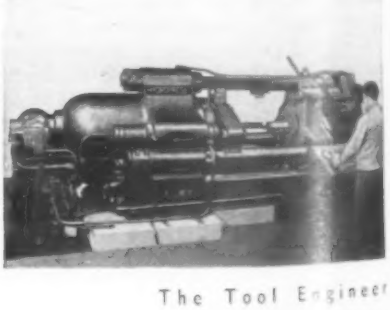
The clutch unit consists of a differential, internal-tooth planetary gear system whereby the sun gear is directly coupled to the motor and the planet gears to the output. When locked by energizing an electro-magnet, the internal gear causes the motor to drive the output shaft. When the electro-magnet is deenergized, the internal gear is released, breaking the driving couple. Positive action is assured with no slipping or wear.

T-11-6

Hydraulic Extrusion Press

A self-contained oil-hydraulic Extrusion Press for rapid and economical production of rods and shapes from light metals and other non-ferrous alloys, by Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y., is now available in 500 and 1000 tons capacity. The unit, for which a production of 50 to 60 billets per hour is claimed, is said to require little floor space and minimum operating personnel.

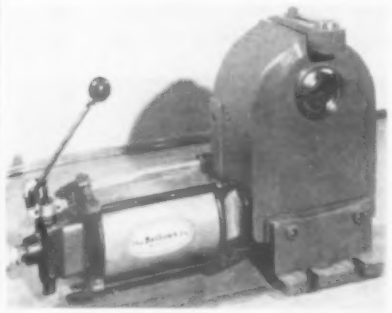
Designed for accessibility and quick change of dies, the machine is especially suited for aluminum and other light metal extrusions such as window sections, ladder sides, trim moldings, ornamental and structural shapes. T-11-7



Interchangeable Pilots
Radial Drive Counterbore
Pin Drive Counterbore
STANDARD ECLIPSE TOOLS
Eclipse at all times stocks 1,000 Standard items (in 100,000 quantity) for immediate delivery to you. Let Eclipse carry your inventory of fine cutting tools!
Balanced Drive Inverted Spotfacer
Self-Centering Countersink
Two Piece Core Drill
Piloted Countersink
Interchangeable Counterbore Set
ECLIPSE COUNTERBORE CO.
Founded thirty five years ago
DETROIT 20, MICHIGAN

Air-Power Collet Chuck

A heavy-duty "Controlled-Air-Power" Collet Chuck, named the BZC-10, has been introduced by The Bellows Co., 222 W. Market St., Akron 9, Ohio. Powered by a Bellows BM-10 air motor which develops a thrust 10 times the operating air line pressure, the holding power of the Bellows BZC-10 Collet Chuck is said to be sufficient to withstand severe types of drilling, tapping and milling without fear of the part or work piece slipping or twisting in the collet. At 60 lb air line pressure gripping power equals approximately 185 foot pounds torque.



The BZC-10 is an almost universal collet chuck, handling most standard collets with stock clearance up to $1\frac{3}{8}$ in. With an adaptor unit, furnished on order, it will handle practically any standard externally threaded draw type collet. Variations in diameters of work pieces or stock can be handled with the collet permitting passing of stock up to a maximum size limit of 0.020 in. An adjustable positive stop can be installed as optional equipment.

A unique feature of the chuck is the "dead man" safety control, the unit being so designed that, in event of air pressure failure, it will still hold securely. Air pressure must be applied before work can be released.

The chuck may be mounted in any position and, for example, is easily adapted to cross-drilling operations. Ample chip clearance is provided at the base, and collets to be removed or changed without taking the chuck from the table. The Bellows Collet Chuck is available either with a manually operated valve, or with the Bellows electrically controlled air-powered-valve.

T-11-8

Power Hack Saw Blade

The W. O. Barnes Company, Inc., Detroit 7, Mich., announces the "Red Rocket" Power Hack Saw Blade which, recommended for production work, is capable of withstanding heavy feeding pressures because of its toughness and flexibility.

The result of research involving advanced equipment and processing techniques that begin with the steel used for the manufacture of the saws, these characteristics offer production and safety advantages with the shock loads that occur under production cutting conditions.

T-11-9

Finest for SPEED: Taps more quality threads per hour, more holes than any other tapping attachment.

Finest for ACCURACY: Attaches firmly to drill press or tapping device.

Finest for VERSATILITY: Taps anything from soap to nickel steel without pressure on tap—prolongs tap life.

Finest for ADAPTABILITY: Five sizes, standard or built-in models, will fit any drill press or tapping device. 0-1½" cap.

Finest for MAINTENANCE: Requires little or no maintenance.

TORQOMATICS, when used with Jarvis TECNI-TAPS, make the finest possible combination for low-cost, high-quality tapping. Send for free, illustrated, descriptive literature to The Charles L. Jarvis Company, Middletown, Conn.

Jarvis POWER TOOLS

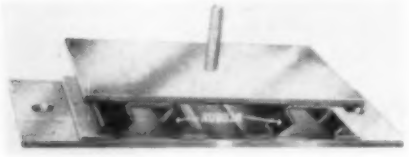
TAPPING ATTACHMENTS
TECNI-TAPS and DIES
ROTARY FILES
FLEXIBLE SHAFTS and MACHINES
QUICK CHANGE CHUCKS and COLLETS

THE CHARLES L. JARVIS CO., MIDDLETOWN IN CONNECTICUT

Finnflex Vibration Mounts

Said to provide a complete and job-proven method of isolating machinery vibration, Finnflex CM-H Vibration Mounts are designed for use with precision grinders, lathes, generators, pumps, compressors, jig borers and other installations where horizontal and rotary machinery vibrations are present.

Vibration isolation, and attendant reduction of noise and resonance, is accomplished through the "rubber-in-shear" principle which, as applied, consists of a specially designed steel channel floated in rubber between two steel angles. The angular relation of the parts enables the isolator to approximate the "flat" spot on a stress-strain curve of relative slope.



CM-H Isolators are said to afford uniform deflection and a load range from 600 to 10,000 lbs. Overall height is only 2 in., making them desirable in installations where any substantial increase in height would be objectionable. Installation is simple, each unit being drilled, tapped and ready for use. Full instructions are furnished by the maker, Finn & Co., 2850 Eighth Ave., New York 30.

T-11-10

Unique Collet Chuck

Featuring advanced design and announced by The Jacobs Manufacturing Company, the Jacobs Spindle Nose Lathe Collet Chuck promises marked advantages over conventional collet equipment. Among these is unusual accuracy with runout at the nose and at points several inches from the nose claimed to be much less than for present split steel collet chucks.

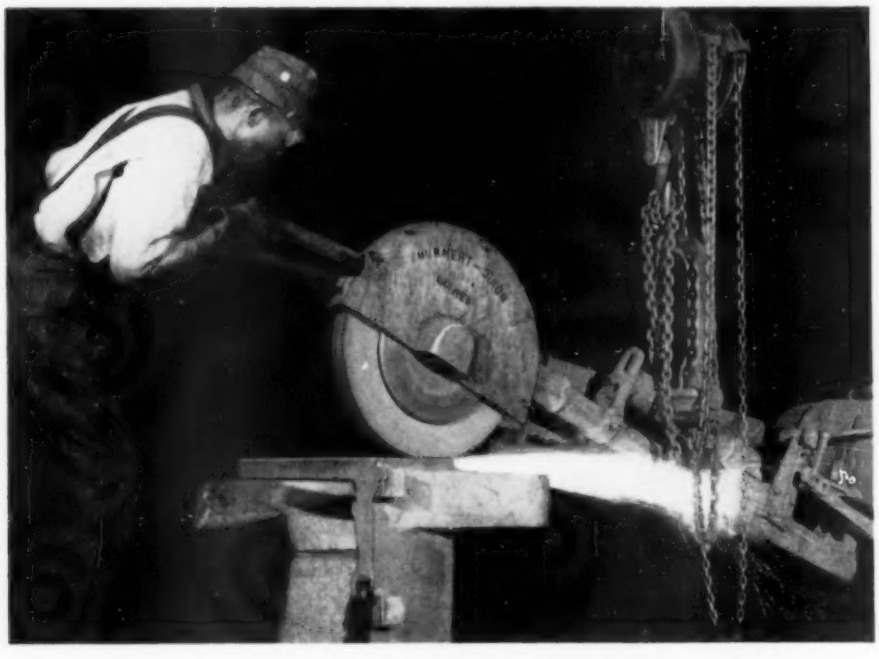
The maker claims tremendous gripping power, said to have been established as from two to four times the grip of split steel collets, a feature which should permit the highest speeds and feeds available in the most modern tool room lathes without danger of slipping or scoring the work.

One important key to performance lies in the Rubber-Flex Collet. Composed of special Hycar synthetic rubber, bonded and mechanically locked to hardened and ground tool steel jaws, each collet has a full ⅛ in. gripping range. On this basis, only eleven collets are needed to chuck bars between 1/16 and 1⅜ in. diameter, and these further eliminate the necessity of purchasing special decimal and metric collets.

Among important considerations is the ease with which the work is tightened and loosened in the chuck. A special impact mechanism both locks and frees the work with a few sharp impacts administered by quickly rotating the handwheel. Models are now available for camlock, taper key drive, American Standard and threaded spindles, and suitable models to fit all other standard lathes are being developed. Catalog available from The Jacobs Manufacturing Company, West Hartford 10, Conn. T-11-11

Flexible All-Metal Gasket

A flexible all-metal Gasket, by the Flexitallic Gasket Co., 8th & Bailey Sts., Camden 2, N. J., is said to possess the qualities of solid metal without its characteristic rigidity. It is said to retain the resiliency necessary to maintain a tight seal even after extended service involving extreme changes in pressure and temperature. T-11-12



MANHATTAN Abrasive Wheels
For Heavy High-Speed GRINDING

Custom engineered for your job, Manhattan Abrasive Wheels cut cost and speed production on all grinding operations.

Exclusive Manhattan developments in both Rubber and Resinoid Bonding assure you production economies of fast metal removal with long wheel life.

Ask to have a Manhattan Field Engineer call at your plant. His suggestions may well mean more production—faster—at less cost. There is no obligation.

ABRASIVE WHEEL DEPARTMENT

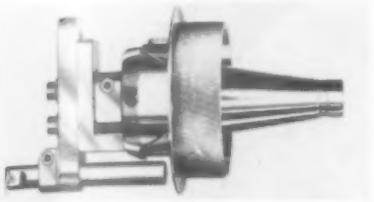
RAYBESTOS-MANHATTAN INC.

Keep Ahead with Manhattan

MANHATTAN RUBBER DIVISION PASSAIC, NEW JERSEY

Off-set Boring Heads

Constructed for accuracy and simplicity of operation, Everede Offset Boring Heads are now available in three convenient sizes for use in any type boring machine or turret lathe. The tools are made of hardened ground alloy tool steel and have maximum bearing surfaces to keep chattering on heavy cuts to a minimum.



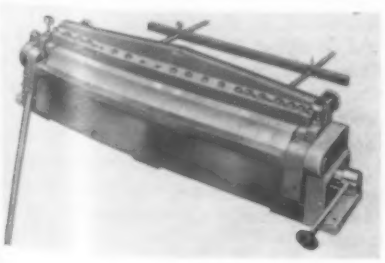
A direct-reading friction type dial assures quick, accurate adjustment and, by having the lead screw off-center of the head, it is possible to adjust the length of the boring bars for shallow or deep hole boring. Extension attachments, furnished for the larger and intermediate size boring heads, increase their capacity 50%. As an example, the No. 4-50 Everede Head has a normal boring capacity of 6 in. and, with the use of the extension bracket illustrated, it is possible to bore a 12 in. diameter hole or face an area of 113 square in.

Facing operations are performed with the use of a removal collar, which is available for each size head. The collar, knurled for easier handling and provided with a safety flange, contains retractable pins that permit either 0.0025 or 0.005 in. feed per revolution. Complete information may be had from Everede Tool Company, Dept. AM, 2000 No. Parkside Ave., Chicago 39, Ill. **T-11-13**

24-Inch Box and Pan Brake

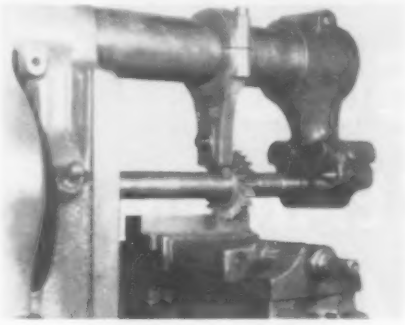
A 24-inch Box and Pan Brake, introduced by Berkroy Products, Inc., 2516 No. Ontario St., Burbank, Calif., is designed to handle many types of industrial metal forming, production operations, experimental shop work and model building. Bending sheet steel up to 16 ga. and 24 in. wide, it folds boxes and makes a variety of more complicated folds and reverse bends.

As features, the bending leaf operates on needle bearings. There is a full one-inch clearance between top fingers and anvil and, by turning a knob, a positive, cam-actuated angle stop provides infinite adjustment to any desired angle from 0 to 135 deg. Full information may be had from the maker. **T-11-14**



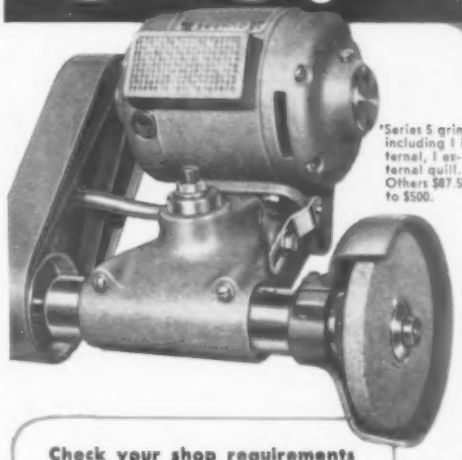
Auxiliary Arbor Support

An adjustable Auxiliary Arbor Support, announced by The Federal Machine Tool Company, Emmett St., Bristol, Conn., incorporates features of interest to users of milling machines. Designed to fit practically all known makes and models of milling machines having a round overarm, the support is said to definitely increase the life of both cutter and machine because it permits the machine to be operated faster while the cut can be deeper. Preventing the arbor from springing, it allows working to closer tolerances.

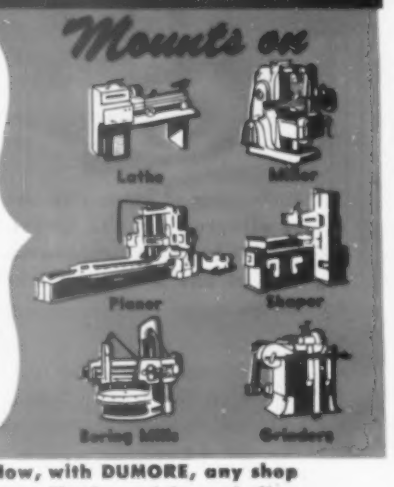


The support can be attached close to the cutter without interfering with the operation and is adjustable for use on any diameter arbor. When ordering, the customer need only to specify the diameter of the overarm and approximate distance between overarm and arbor. **T-11-15**

$310* puts .0001" precision grinding in your shop



*Series 5 grinder including 1 internal, 1 external quill. Others $87.50 to $500.



Check your shop requirements against these DUMORE features

LOW COST — Versatile Dumores cost as little as 1/50th of single-purpose grinder price.

.0001" ACCURACY — Dumores enable you to grind to the closest practical precision limits.

MICRO-FINISH — Dumores will enable you to obtain the finest ground finish on your work.

WIDE WORK RANGE — Handles cylindrical, internal, external, form, and surface grinding.

ADAPTABILITY — A Dumore mounts on any of your basic shop machines.

HIGH PRODUCTION — Hundreds of Dumores are in daily use on production jobs of every type.

SERVICE — Wherever you are, Dumore parts and service instantly available.

Now, with DUMORE, any shop can afford precision grinding

For small shops it means more jobs to bid . . . tool and die facilities . . . more profits.

In large shops it frees expensive machines for long runs . . . uses idle machines . . . handles "one-shot" jobs . . . cuts maintenance costs.

See for yourself how Dumores turn out work faster, better and cheaper.

Write today.

Mail Today

The DUMORE COMPANY, Dept. L-13 Racine, Wis.

☐ Please send me information on how Dumore Precision Grinders can cut my tool and work costs.

☐ Please arrange for free demonstration in my own shop. I'm particularly interested in ☐ Toolroom ☐ Production ☐ Maintenance applications.

NAME..... TITLE.....

COMPANY.....

STREET.....

CITY..... STATE..... DG-1

DUMORE

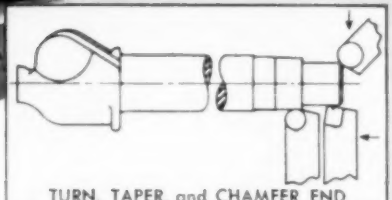
Saves $34,560 IN ONE YEAR with KENNAMETAL TOOLING

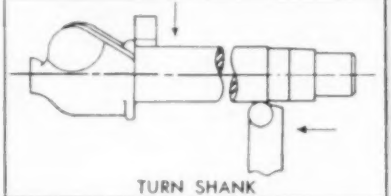
A manufacturer of automotive steering gears effected annual savings of $34,560.00 by using Kennametal tooling on just one series of machining operations.

Details of the job are given at the right —the basic tools used, Styles RAL and SBR, are illustrated above. This report indicates the enormous savings attainable through the application of modern tooling.

Here again Kennametal proves its worth. A few pennies saved in the initial cost means nothing. Consider these facts: (1) Fewer tools are required, as a rule; (2) Set-up and machine downtime are minimized; (3) Load and confusion in grinding room is reduced; (4) Higher production rates can be reached, and maintained.

Ask us to send you performance reports that show how other shops are achieving cost reduction by tooling with Kennametal.


TURN, TAPER, and CHAMFER END


TURN SHANK

The operations illustrated above required ten single-point brazed tools. Four Kennamatic tools are now being used. The savings on each 1000 pieces machined is $24.00, as detailed below. A total savings of $34,560.00 was realized over a 12-month period.

TOOL PERFORMANCE

	Single-Point	Kennamatic
Number Required	10	4
Cost Each (Avg.)	$2.50	$4.10
Pieces/Grind	200	1,600
Pieces/Tool Life	2,000	24,000

SHOP COST/1000 PIECES

	Single-Point	Kennamatic
Tool Cost	$15.00	$ 1.93
Productive Labor	15.12	9.32
Non-Productive Labor	6.00	0.87
Shop Cost/1000 pcs.	$36.12	$12.12

ROUGH FORGING

FINISHED

KENNAMETAL Inc.
LATROBE, PA.
MANUFACTURERS OF SUPERIOR CEMENTED CARBIDES AND CUTTING TOOLS THAT INCREASE PRODUCTIVITY

Improved End Mills

As a result of completely redesigning its end mills, the Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, has developed a tool said to have strength, speed and accuracy to a degree not previously obtainable.

Major design innovations include improved clearance and accurate machine polish of flutes, resulting in closer control of size. There are no pockets, and chips are free to move. A minimum amount of metal has been cut away, with absence of sharp corners where stresses might localize. These and other improvements are said to provide maximum cutting qualities at increased rates of feed. Full information may be had from the manufacturer. T-11-16

Granite Angle Plates

Precision Angle Plates, as announced by Rahn Granite Surface Plate Co., 1149 Platt Circle, Dayton 7, Ohio, are made of black granite to a claimed tolerance of less than one second of arc which, in linear dimensions, implies accuracy of 0.00005 in. in 12 inches.

Original accuracy in manufacture is said to be maintained indefinitely due to the nature of black granite which, harder than tool steel, has been aged, normalized and stress relieved for eons. The granite will not rust and, should it be accidentally nicked, no burr will be raised. Neither can abrasives become imbedded in the surface.

Illustrated is an application of a 6x9x12 in. precision angle plate being used on a jig borer. These plates are also used for inspection work on surface plates, and can be furnished with any number of finished faces. Their permanent accuracy is said to make them especially dependable for use as masters. T-11-17

Holder Reduces Vibration

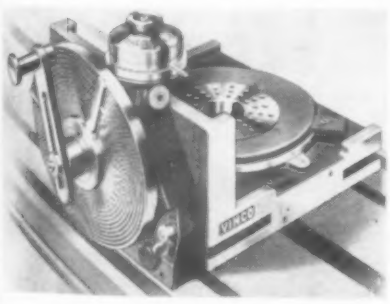
A Tool Holder with a locking method said to eliminate bit vibration and to reduce tool breakage is announced by the American Die and Tool Co., Reading, Pa. It is immediately available for round, square, rectangular and triangular bits of all standard sizes, and custom-made tools are also available for special requirements.

Known as the Redy Rigid tool holder, the device clamps the carbide bit against the work surface with maximum rigidity by means of a lock block, screw, and lock nut arrangement which, it is claimed, will not work loose even on automatic machines.

In addition to increasing tool life, the holder is said to give more production between grinds and, because of its extreme tightness and rigidity, to provide considerably greater production before regrinding. Only one brazing is needed to an entire bit. **T-11-18**

Work Indexing Fixture

A work indexing fixture of high accuracy — the Precisiondex — by Vinco Corporation, 9111 Schaefer Hwy., Detroit 28, Mich., has a guaranteed indexing accuracy of within 30 seconds of arc. It is adaptable to a wide range of work including jig boring and grinding, light milling and shaping, engraving, profiling, graduating and inspection.



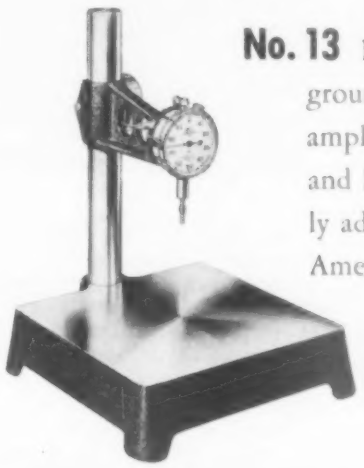
Sturdily built, all parts essential to its accuracy are precision ground and lapped. The bottom and two side surfaces are flat and said to be square within 0.0002 in. This permits work of high accuracy to be done either horizontally or vertically.

The micrometer has a ratchet and pawl arrangement, with clear-cut markings by which settings in seconds are made, thereby enabling a predetermined number of seconds to be added consecutively to each index. A simple one-piece clamp tightens down on the rim of the work plate, thus prohibiting side play or distortion in final settings. **T-11-19**

AMES **NOW**

GREATLY INCREASED MEASURING CAPACITY FOR AMES No. 13 & No. 130 DIAL COMPARATORS

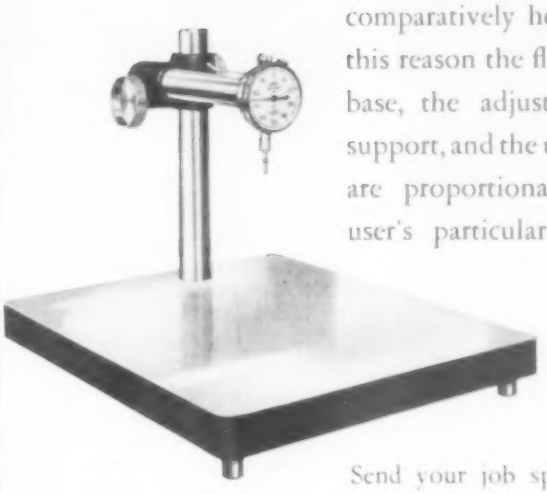
Inspection of a much wider variety of parts is possible with Ames No. 13 and No. 130 Dial Comparators, now that longer columns—12", 18" and 24"—have provided them with unusually long ranges.



No. 13 Dial Comparator features ground-flat cast-iron base of ample size for using V-blocks and locating fixtures. Accurately adjustable bracket holds any Ames Precision Dial Indicator. Measuring capacities available–6", 9", 15", 21".

Representatives in principal cities. B. C. AMES CO. *30 Ames Street Waltham 54, Mass.*

Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators



No. 130 Dial Comparator is designed especially for inspecting comparatively heavy parts. For this reason the flat-ground steel base, the adjustable indicator support, and the upright column are proportional to suit the user's particular requirements.

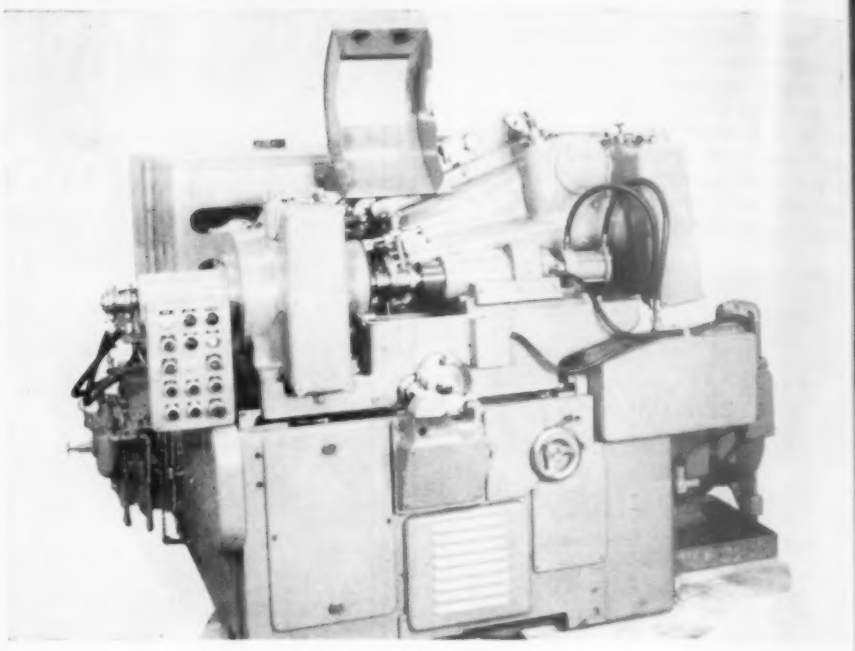
Send your job specifications and we will supply complete details without obligation.

100%
OF ALL METAL CUTTING JOBS CAN BE DONE AT LOWER COST with Stuart's Wise Economy Plan

Write, wire or phone for details.

D.A. Stuart Oil Co.
2727-49 S. Troy St., Chicago 23, Ill.

Spur and Helical Gear Finisher



The Fellows Gear Shaper Company, Springfield, Vt., has placed on the market a machine said to represent a revolutionary development in the finishing of gears. This machine, which was introduced at the recent Machine Tool Show held at the Fellows plant, operates on a principle in which the cutter is set at an angle relative to the work. As shown in the small photo, these cutters have teeth of helicoidal shape, and are sharpened by face grinding in a similar manner to spur gear shaper cutters.

An advantage claimed for this type of cutter is its ability to cut freely without burnishing effect on the work. The cutter finishes both sides of the teeth in one traverse and, since the feed can be varied through change gears, any desired finish can be obtained. The machine, said to be easy to set-up and convenient to operate, is designed so that air-operated work-holding fixtures can be applied for clamping and unclamping the work, and it is also provided with a tail-stock for supporting stem pinions.

Operating cycle is as follows: When the gear is completed the machine stops automatically and the work back away from the cutter an amount equal to the depth of cut. The operator elevates the safety guard, which breaks contact with the button controlling the air-operated clamping mechanism. He then removes the finished gear, and inserts an unfinished gear, the cutter acting as a setting gage. Depressing the "start" button operates the clamping mechanism and prepares the machine to start as soon as the safety guard is lowered. Cutter and work start rotating with a light clamping pressure on the work.

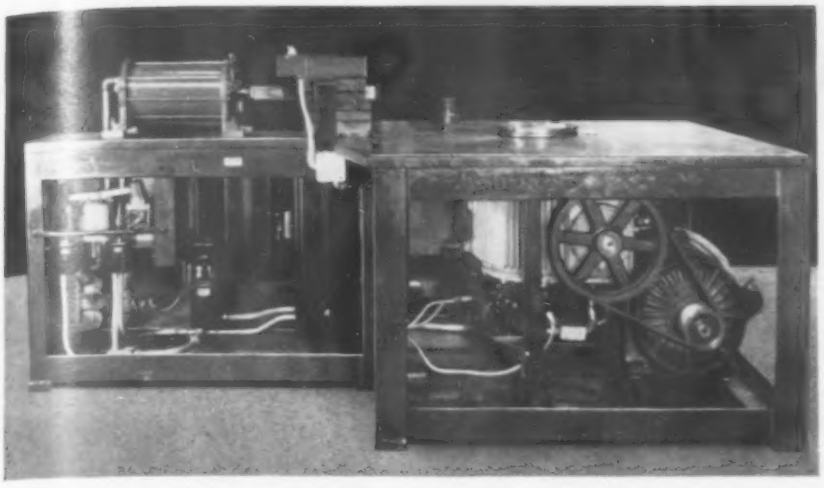
After a short interval, full clamping pressure is applied and, at the same time, the work withdraws from the cutter, which is rapidly traversed across the work to the "starting point". The work is then automatically advanced to depth of cut and the cutter is traversed across the work at the desired feed. With the exception of loading and unloading the work, the machine is entirely automatic in operation. It is automatically lubricated.

A magnetic chip separator prevents chips from being carried in the cutting oil and thus marring the finish on the work. Maximum capacities of the machine are as follows: pitch diameter of work, 12 in., O.D. 12½ in., diametral pitch, 5, outside diameter of cutter, 7¼ in. Maximum face width is 8-¾ in. normally, but 6½ in. for gears over 9 in. diameter. Maximum helix angle is 45 deg. T-11-20

All-Position Electrode

Eutectic Welding Alloys Corporation, 40 Worth St., New York 13, N.Y., announces a General Purpose Electrode for steel sheet and plates said to have unusual properties of quick solidification, making it ideal for uphand welding and especially for "poor fit" joints. Known as Eutectrode 6000, for both AC and DC, this arc welding electrode is recommended by the maker for single or multiple pass welding where fit up is poor. Its high burnoff rate permits use of high currents with resultant faster welding speeds. Available in sizes 3/32, 1/8, 5/32 and 3/16 in., Eutectrode 6000 has Brinell hardness of 200 and high tensile strength of 64,000–72,000 psi. T-11-21

Automatic Power Bender



A line of Power Benders, by the Hancock Tool & Die Corp., 17005 Fullerton Ave., Detroit 27, Mich., incorporates a pressure cylinder arrangement by which the work is bent around a rotary fixture. Fixtures, suited to various bends and contours of work, are interchangeable on the rotating fixture table.

Features of the machines, of which the one shown has a torque capacity of 44,000 lb, include high torque output, all-electric controls and both manual and automatic cycle operation. The machines can be readily arranged to meet individual requirements.

To bend work, the operator needs merely to clamp one end of a tube or length of rolled stock in the fixture and to press a starting button. The fixture then revolves, the actual forming being done by an air-cylinder-actuated shoe pressing against the work. The machine stops automatically at the end of the bending cycle.

T-11-22

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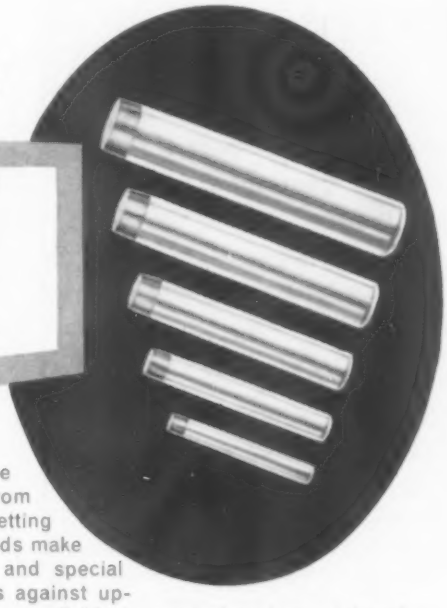
DOWEL PINS

Danly Precision Dowel Pins save time on any precision alignment job, from locating delicate die components to setting heavy machine parts. Tapered lead ends make driving easier in close fitting holes and special hardening (58-60 Rockwell C) guards against up-setting. Two complete size ranges are available to meet almost every dowel requirement . . . one range ground for new application and the other ground .001" oversize to permit accurate redoweling in enlarged holes.
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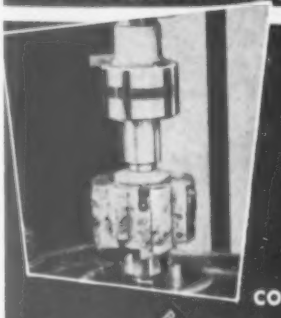
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NEW HAVEN 5, CONNECTICUT, U. S. A.

Alloy Steel Plate

W. J. Holliday & Co., Inc., with plants at Indianapolis and Hammond, Ind., have announced "Speed Alloy" as an addition to their line of speed steels. Speed Alloy is a hot rolled alloy steel plate available from stock in widths up to 72 in. and thicknesses to 6 in. Developed to bridge the gap between carbon and tool steels, its deep hardening properties, gained by the addition of chromium and molybdenum, permit its use where relatively high compressive strengths are required.

Speed Alloy is said to assure the economical production of molds and dies, with physical properties making it entirely suitable for a wide range of applications for such machined parts as cams, gears, racks, ways, platens, yokes, and zinc die casting dies.

Essentially an oil hardening steel affording surface hardness up to 400 Brinell, depending upon the section, it is said to lend itself ideally to carburizing, with resulting high surface hardness. Fully described in Bulletin 905, sent on request. T-11-23

Round Endless Belts

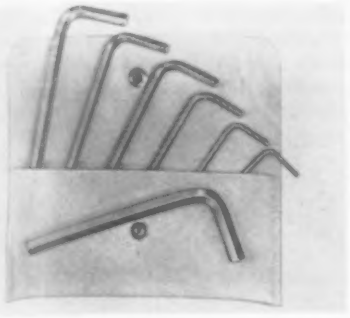
United States Rubber Company has announced the addition of round endless belts to its U. S. Rainbow line for use on drills, high speed hammers, tappers, saws, sewing machines, wood working tools and other small machinery applications.

Available in sizes ranging from 3/16 to ½ in. belt diameter, and from 6⅞ to 156⅜ in. inside circumference, the belts are of round cross section design built without a splice, a construction that helps to eliminate vibration.

Cord pulling members keep stretch at a minimum, and bias cut jackets protect the inner structure and insure flexibility. Recommended by the maker for quarter turn, mule, serpentine, cross drives, and many other special wheel turning applications, endless round belts are said to be easily be shifted on step-up pulleys for speed changes. T-11-24

Socket Screw Key Sets

Five Holo-Krome Key Sets are now available in modern Plastic Paks. Light in weight yet strong and durable, with snap fasteners on the cover, these key sets contain the right quantity and the correct sizes for the greatest number of socket screw applications within each set classification. For convenience some of the "HK" key sets have individual pockets for the keys.

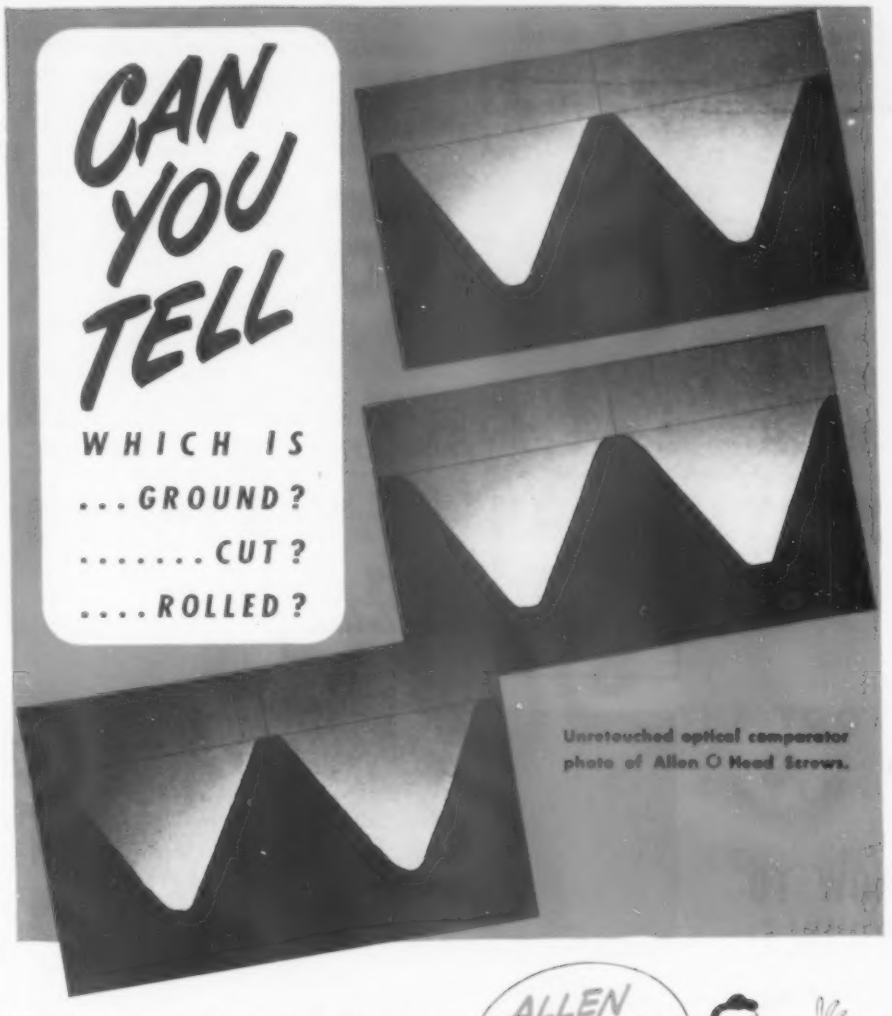


The short arm series keys, in sets No. 6 and 7, are for servicing instruments, radios, motors and equipment where small diameter screws are used. The long arm series keys, in sets No. 107 and 113, are useful for electrical appliance work and similar light jobs. The extra long arm series keys—set No. 113—meets the demands of servicemen on oil burners, television sets and wherever screws are difficult to get at. Sets No. 44 and 66 are furnished in heavy gage crackle enamel finish metal boxes with hinged snap on covers and metal separators to permit grouping of keys to size. Made of special analysis nickel alloy steel and held to extremely close limits, Holo-Krome keys are correctly proportioned to give proper leverage and scientifically designed to avoid corner strain. Heat treatment produces keys with "Wear-Hard" surfaces and tough cores, spring tempered. Descriptive Catalog No. 49 and a full page chart shows the interchangeability of "HK" keys may be had from the Holo-Krome Screw Corp., Hartford 10, Conn. **T-11-25**

A Versatile Clamp

A unique industrial clamp—the "Negator"—has automatic takeup and such unusual range and flexibility that it can clamp around bends and corners. Actually, the clamp consists of flat spring stock coiled on opposite ends, between which there is constant clamping pressure from zero to maximum opening.

The clamp has almost unlimited application, but for industrial purposes may be used to position light component parts during welding, assembly, drilling and gaging, or as a vise-clamp for gluing. Supplied in band widths ¼ to 2 in. and, currently, with clamping pressures from 2 oz to 20 lb in eight increments. Full information of these versatile tools may be had from Hunter Spring Co., 1 Spring St., Lansdale, Pa. **T-11-26**



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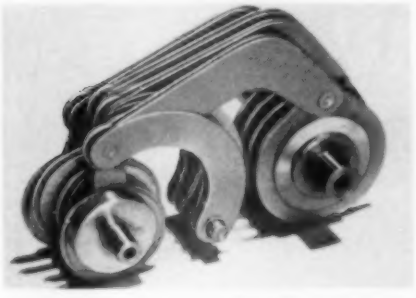
Variable Speed Control

Revco Incorporated, 405 Thorpe Bldg., Minneapolis, Minn., announces a speed control device—the "Zero-Max"—said to be infinitely variable from zero to maximum. A torque conversion structure, its operating principle involves the use of a crank motion on the input shaft creating linear motion which, in turn, is absorbed on the output shaft by a series of one-way overriding clutches. A leverage mechanism, placed between the two shaft structures for infinitely varying the length of the stroke from zero to maximum, provides an infinite speed variation from zero to 4-1 ratio.

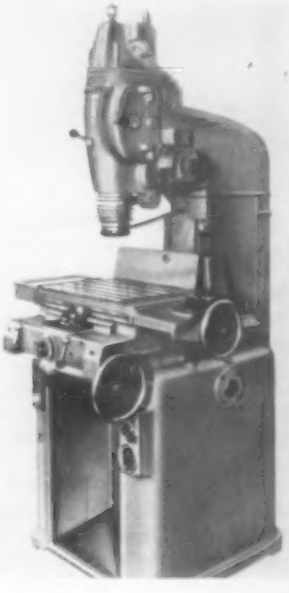


Advantages claimed for the "Zero-Max" are that it is compact, can be mounted in any position, provides level flow of power, has instant response to change of speed which can be made either while operating or stopped, excellent low speed as well as high speed performance, high starting torque, silent operation and low original cost.

T-11-27

Precision Jig Grinder

A Swiss precision Jig Grinder, said to combine highest accuracy with exceptional output capacity, is now available from Hauser Machine Tool Corp., Manhasset, N. Y., exclusive U. S. factory representative of Henri Hauser, Ltd., Bienne, Switzerland. This grinder —model 3S—is of a larger size than the Hauser type 2S and has a capacity grinding diameter of 5 inches.



The spindle unit, which is quickly interchangeable, incorporates automatically-lubricated precision ball and roller bearings and is driven by compressed air. By adjusting the airline pressure, spindle speeds up to 75,000 rpm are obtainable. Bores are ground on the principle of the planetary spindle. Small and medium size holes are ground with the normal high-speed grinding spindle, larger holes—up to 5 in.—with a special set-off grinding head with eccentric adjustment. Grinding feed can be made by handwheel and graduated dial while the machine is in operation.

Provision is made for grinding taper holes with an included angle up to 3 deg on a length of 2 5/16 in., and with somewhat smaller angles for lengths up to the 3 9/16 in. vertical travel of amount of taper are made by direct the grinding spindle. Settings for the reference to a scale.

The working surface of the Hauser 3S table is 22 x 12¾ in., with a longitudinal and transverse travel 15 and 10 in., respectively. Co-ordinate settings are made by means of precision ground-thread lead screws fitted with pitch-correction devices. Dividing drums and verniers, reading to 0.0001 in., are protected by glass windows and electrically illuminated. This interesting precision tool is fully described in a bulletin which includes complete technical data.

T-11-28

The Monthly Robertson Bulletin

HOW TO DOUBLE OUTPUT ON SURFACE GRINDERS

That's not so difficult as it sounds. Whether you're working on tiny pieces or 30″ x 3″ bars, you'll get better results from your surface grinders when they are equipped with Robertson Cool-Cut Wheels. Time and time again, Robertson Wheels have demonstrated their ability to cut grinding time in half—*or better*. For instance:

This manufacturer was grinding hardened and soft steel stock on a Mattison surface grinder to a required finish of 15 microinches. With a conventional grinding wheel, it took one hour and 30 minutes to do all four sides. When he switched to a 20″ x 6″ x 10″ WA 362-IVC Robertson Wheel, this time was reduced to 45 minutes. Stock removal averaged .030″ to .035″. Table speed was reduced to 40 feet per minute and cross feed to the lowest position.

In addition, the Robertson Wheel required less truing than the conventional wheel and did its job with little or no wear. An increase of 100 percent in productivity . . . and at lessened wheel costs!

Results like these are not rare, but are being achieved daily with Robertson Wheels in machine shops all over the country. It will pay you to find out how much more, and better, work Robertson Cool-Cut Wheels can do for you. Send for your free copy of the interesting pocket booklet "How to Buy Production Time"

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Resin-Bonded and Vitrified-Bonded Grinding Wheels • Mounted Wheels • Segments

Automatic Gear Loading

About 18 months ago, National Broach & Machine Company introduced a fully automatic Gear Loader for gear shaving machines. Originally applicable only to small pinion gears, further development by Red Ring engineers now makes it possible for gear manufacturers to shave all types of external transmission gears regardless of size, cluster, stem and timing gears included.

Equipped with the automatic loader, the gear shaving machine will run continuously as long as the magazine is kept filled with the workpieces. And one operator should easily be able to keep the magazines of several machines filled with all machines running continuously.

Shown is a Model GCU Diagonal Gear Shaving Machine, with automatic loader, shaving a 32-tooth constant mesh transmission gear at the end of a cluster. This is a helical gear, 3.765 in. pitch diameter and ⅝ in. face. Overall length is 5.809 in., and actual floor to floor time is said to be only 16 seconds—or at rate of 191 per hour at 85% efficiency. The three smaller gears in the same cluster can also be shaved, using the same loader but changing the setup. Complete information on automatic gear loading may be had by writing National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich. **T-11-29**

Besly Adds High-Speed Drills

High-speed Twist Drills and Reamers have been added to the present line of taps, abrasive wheels, grinders and accessories by Charles H. Besly & Company, 118-124 N. Clinton St., Chicago 6, Ill. All styles and sizes of drills and reamers are to be available, with the more popular kinds carried in stock for immediate delivery from Chicago.

Like Besly Taps, the drills and reamers will be sold through a selected group of industrial distributors throughout the country. **T-11-30**

Precision Indexing Fixture

Highly accurate and rapid indexing of work pieces is said to be possible with the Ettco-Emrick No. 97 Electric Indexing Fixture, designed for use with

punch press, tapping machine, drill press and other similar operations. Table indexing motions are controlled electrically through a modified Geneva system to assure smooth, shockless action.

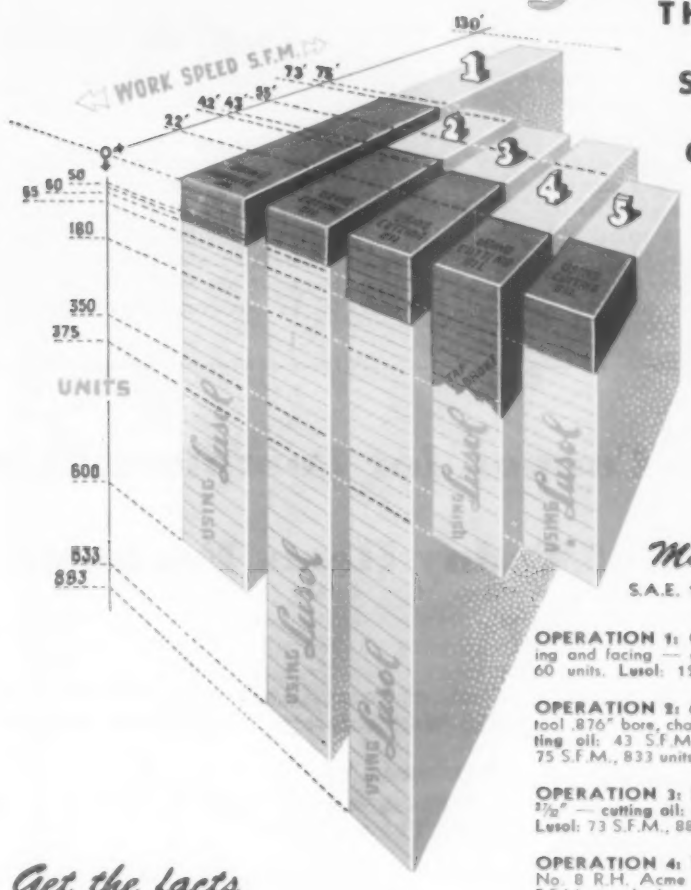
A built-in electric control automatically synchronizes the movement of the spindle and the table and also controls the downward motion of the spindle. The unit is available with a choice of interchangeable indexing plates ranging in size from ten to fourteen inches in diameter. Engineering cooperation is available in designing plates to suit individual requirements. Full details are available in Bulletin 97. **T-11-31**

BONNET [FOR 1 INCH 600 lb. VALVE] **PRODUCTION**

INCREASED WITH

Lusol

THE TOOL SAVING COOLANT



Material used

S.A.E. 1035 FORGED STEEL

OPERATION 1: Carbide tool bit, turning and facing — **cutting oil:** 73 S.F.M., 60 units. **Lusol:** 128 S.F.M., 600 units.

OPERATION 2: 6 flute H.S.S. boring tool .876" bore, chamfer top to 1⅝" — **cutting oil:** 43 S.F.M., 50 units — **Lusol:** 75 S.F.M., 833 units.

OPERATION 3: H.S.S. taper shank drill 2⅞" — **cutting oil:** 42 S.F.M., 65 units — **Lusol:** 73 S.F.M., 883 units.

OPERATION 4: Tandem type lead ⅛" No. 8 R.H. Acme tap — **cutting oil:** 22 S.F.M. tap broke at 160 units — **Lusol:** (with single lead) 73 S.F.M., 375 units.

OPERATION 5: Die chasers for 1¾ No. 12 N.S.T. — **cutting oil:** 22 S.F.M., 55 units — **Lusol:** 55 S.F.M., 350 units.

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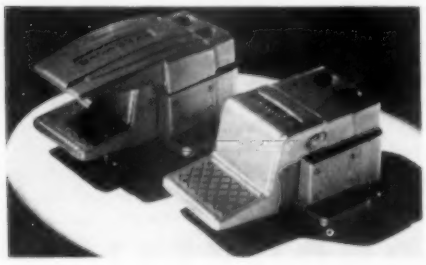
4AD40

Foot-operated Control Valve

An effortless foot operated air-cylinder Control Valve, announced by Hannifin Corp., 1119 So. Kilbourn Ave., Chicago 24, Ill., is a reciprocating, packless, disc type valve known as Model NFS.



Piston operated and pilot controlled, this latest addition to the Hannifin "Directaire" series of air control valves is designed to direct compressed air alternately to two pressure ports for the operation of a double-acting air cylinder. The sliding, self-lapping main valve disc is shifted by a reciprocating light metal piston, which is moved by alternately admitting line pressure to one end and venting the other.

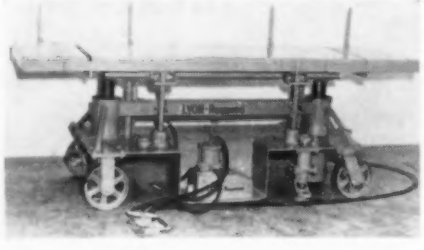
Although ruggedly constructed to withstand the full weight of any operator, these valves are designed to respond to "tip-toe" touch. The foot actually operates only a small pilot valve and moves less than ¾ in. under very slight foot pressure for quick, easy action. Air pressure replaces muscular effort in the shifting of the main valve disc.

Constructed to operate with air pressures from 25 to 150 lb per square inch, the "Directaire" model is now being manufactured in ½ and ¾ in. sizes. Safety guards, which extend over the pedals and minimize the possibility of unintentional operation, are optional.

T-11-32

Sheet Feeding Table

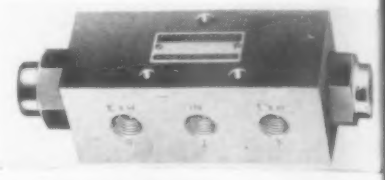
The Lyon-Raymond Hydraulic Elevating Sheet Feeding Tables are raised and lowered by an air-operated hydraulic pump which, in turn, is operated by a compressed air motor. Thus, the table elevates each time the control pedal is pressed down. To lower the table, a release pedal allows the oil to flow back into the reservoir.



Load capacity claimed for steel strips or sheets is up to 6000 lb. Loads can be elevated so that the top sheet is always level with the press bed for fast, easy feeding. The table also has a tilt top arrangement for use with inclined bed presses. This equipment is fully described in literature available from Lyon-Raymond Corp., 9756 Madison St., Greene, N. Y. **T-11-33**

Double Piloted Valve

C. B. Hunt & Son, Inc., Salem, Ohio, has introduced a line of double piloted single plunger Valves featuring simplicity in design, and what is said to be extreme ease of operation. The pilot cylinder is designed for operation at pressures as low as 25 psi, permitting the use of these valves at most instrument air pressures and making them suited for use in safety control arrangements.



The valves, which consist of an aluminum housing, a hollow stainless steel plunger with precision placed ports, and stainless steel pilot pistons mounted in brass pilot cylinders, may be completely disassembled and reassembled without disturbing the main piping. Furnished tapped for either ⅛ or ¼ in. pipe connection, in 2-way; 3-way; double 2-way; 4-way; and 5-way designs for use with air, oil or water at line pressures up to 125 psi maximum (also vacuum), at normal temperatures not exceeding 150 deg F. **T-11-34**

Use This Coupon for Complete Information On Tools of Today Items Featured This Month

For your convenience, a key number follows the announcement of each product reviewed in the *Tools of Today* section of THE TOOL ENGINEER. To obtain complete information on any of these products, circle the corresponding key numbers on this coupon, and mail the coupon to THE TOOL ENGINEER.

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T-11-10 T-11-11 T-11-12 T-11-13 T-11-14 T-11-15 T-11-16 T-11-17 T-11-18
T-11-19 T-11-20 T-11-21 T-11-22 T-11-23 T-11-24 T-11-25 T-11-26 T-11-27
T-11-28 T-11-29 T-11-30 T-11-31 T-11-32 T-11-33 T-11-34 T-11-35 T-11-36

Name .....

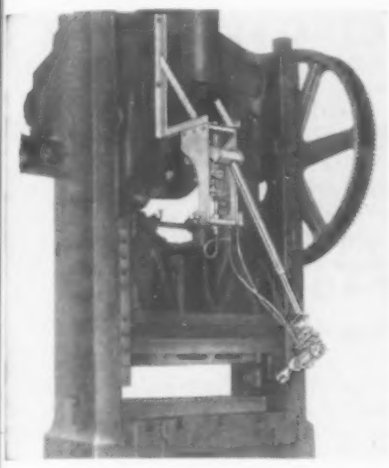
Position .....

Firm .....

Street ..... City, State .....

Junior "Iron Hand"

A junior size Iron Hand, specially designed to accommodate small and medium sized punch presses being used for manufacturer of pressed metal products, is announced by the Sahlin Engineering Company, 467 So. Woodward Ave., Birmingham, Mich. Used to remove sheet metal stampings from presses automatically, it is recommended by the maker for presses with bed widths ranging up to 72 in. and pressure capacities up to 250 tons.



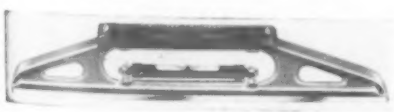
Claimed for the device is safety, higher production, lower operating costs, flexibility of application, simplicity of operation and sturdy construction. Safety is enhanced because the operator need only to place the part in the press, removal being automatic. The unloader is designed to catch at every stroke.

The Iron Hand is entirely self-contained, may be transferred from one press to another, is adaptable to both open and enclosed type presses and can be used, with equal effectiveness, to remove blanks or formed parts. Electrically synchronized with the stroke of the press, it can also be locked out of position for die tryout or when the press is idle.

T-11-35

Precision Aligning Level

In taking over the line of boring, drilling and milling machines of the Universal Boring Machine Co., the Bullard Co., Bridgeport 2, Conn., also acquired the Universal Precision Aligning Level. This level is now manufactured by Bullard in sizes 18 and 27 inches.



Designed and constructed on principles embodied in precision surveying instruments, the body casting is further insulated from the palm of the hand by means of a special non-conductive material. The maker guarantees the sensitiveness of the bubble to 5 seconds of arc per graduation, equivalent to a variation of 0.0003 in. per foot. Further described in Bulletin BUL2-6-49.

T-11-36

WENDT-SONIS

4 Point Plan

TO CUT REAMING COSTS!

1 LESS TOOL COST! W-S complete line of carbide reamers covers over 90% of reaming jobs. Reduced inventory!

2 GREATER ACCURACY! Precision tolerance as close as .0001. Lapped and protected grinding centers for more accurate resharpening.

3 BETTER FINISH! Grinding operations eliminated. All W-S reamers have diamond-lapped cutting edges and special hardened steel bodies stress-relieved before braising.

4 IMPROVED DESIGN! New type of tool construction. Highly polished flutes with greater chip capacity.

Rely on the famous W-S complete line of carbide reamers — tried and proved for 15 years — to improve production at LOWER COST! Complete range of sizes . . . wide selection of styles . . . straight or taper shanks of hardened steel. Quick delivery on standard reamers with special diameters and tolerances. Make your next reamer order a W-S order . . . see your Wendt-Sonis distributor.

Free! NEW REAMING INSTRUCTION CHART

Determines speed and horsepower for cutting steel, ferrous, non-ferrous and non-metallic materials. Write today: WENDT-SONIS COMPANY, Hannibal, Missouri — 580 North Prairie Avenue, Hawthorne, Calif., 549 West Randolph, Chicago, Ill. Warehousing Facilities: Eastern Carbide Corp., 909 Main St., New Rochelle, N. Y.

WENDT SONIS

CARBIDE CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS
DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS
ROLLER TURNING TOOLS • SPECIAL BITS

for the . . .
PLASTICS INDUSTRY
. . . COMPRESSION MOLDS of
SIFCOLOY
CONTROLLED METAL
. . . are Superior
The physical properties of density, strength, surface finish, smoothness, clean cavities . . . requirements so necessary to the component parts of molds used in compression moulding of Plastics . . . make SIFCOLOY a "natural" for this specialized industry. Compared to costly "mold steels", compression molds of SIFCOLOY Controlled Metal are economical, easy to use, cost-cutting, and successful.
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WRITE FOR BULLETIN and COMPLETE INFORMATION
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THE TOOL ENGINEER'S *Service Bureau*

BOOKLETS, CATALOGS CURRENTLY OFFERED BY MANUFACTURERS

Abrasives

"The Finest in Coated Products . . . Carborundum" presents features of service, research and production facilities at Carborundum's Wheatfield plant. P. O. Box 337, *Carborundum Co.*, Niagara Falls, N.Y.

Air Valves

Catalog, Section 301, shows simplified design of line of 4-way air valves; description of each model includes working drawings, specifications for sizes and cut-away views; also contains circuit layouts for important types of control. *Gerotor May Corp.*, Baltimore 3, Md.

Carbide Tools

Supplement No. 7 to General Tool Catalog GT-200 covers line of mechanically held solid carbide "insert" tools, listing specifications and prices on round, square, triangular and rectangular types. *Carboloy Co., Inc.*, Box 237, Roosevelt Park Annex, Detroit 32.

Castings

"Meehanite Means Better Castings", Bulletin 31, fourth in series of application and engineering data booklets, gives specific illustrations of unusual applications plus test data and engineering characteristic charts. *Meehanite Metal Corp.*, Pershing Square Bldg., New Rochell, N. Y.

Chucks

Recently revised engineering catalog, No. 64, includes photos and engineering drawings plus dimentions, weights and price lists for all current types of hand-operated chucks. *Cushman Chuck Co.*, Hartford 2, Conn.

Cutting Tools

Folder pictures typical products and sets forth services of company specializing in cutters, reamers and related products made to customer specification. *Special Cutter & Tool Co.*, Ecorse, Mich.

Cylinders, Air

Eight-page booklet shows detailed dimensional and cross section drawings of B-R cylinders including various types of mountings; plus specification tables for each cylinder type. *Richter-Shillair Co.*, 1317 S. Park St., Saginaw, Mich.

Die Cushions

Pocket-sized reference manual on uses and maintenance of pneumatic and hydropneumatic die cushions and allied equipment for inclinable, enclosed, and single and double crank presses. *E. W. Bliss Co.*, Toledo, Ohio.

Gages

Detailed description of airflow, column type "Precisionaire", its construction, features and special applications, in widely illustrated catalog CTP-491. *The Sheffield Corp.*, Dayton 1, Ohio.

Gear Shavers

Illustrated brochure outlines late developments in gear practice, principles involved in rotary shaving, crossed axes cutting, relation between cutting and grinding action, elliptoid tooth form and aviation gears, with particular discussion of Red Ring gear shaving machines. *National Broach Machine Co.*, 5600 St. Jean, Detroit 13.

Lathes, Heavy Duty

Highly illustrated 36-page booklet shows quality controls, various steps in precision manufacture, advantages and heavy duty accessories for line of lathes. *Monarch Machine Tool Co.*, Sidney, Ohio.

Motors

Performance graphs, wiring diagram and photos showing typical applications illustrate brochure on variable speed a-c motor. Action as well as special parts fully described. *Louis Allis Co.*, 427 E. Stewart St., Milwaukee 7, Wis.

Presses

Circular P-49 covers line of vertical hydraulic presses for broaching, forcing straightening, staking, assembling; includes extensive specification table. *Acme Broach Corp.*, Milan, Mich.

CORRECTION

In the October issue under Die Polishing, leaflet describing machine for polishing dies by using endless abrasive belt was incorrectly credited to the Whiton Special Machinery Co. It should have read THE HARTFORD SPECIAL MACHINERY CO. of Hartford, Conn.

Screw Products

Cutaway and diagrammatic drawings illustrate line of B-Right-On socket screw products. Incorporated are price and specification lists while thread lengths and shipping weights are shown on tabular charts. *Brighton Screw & Mfg. Co.* Engineering Dept., Reading Rd., Cincinnati.

Socket Screws

List price booklet No. 49, for both standard and special sizes, shows items of cold forged socket screw line accompanied by descriptive data charts. *Holo-Krome Screw Corp.*, Hartford 10, Conn.

Stampings and Assemblies

Folder pictures advantages and uses of light weight aluminum stampings and assemblies, dwells on problems of rejects and scrap handling. *Reynolds Metals Co.*, 2500 So. Third St., Louisville, Ky.

Steel Castings

Extensive illustrations show castings for use in manufacturing for construction metal working, power plant, electrical and defense equipment among many others; also discussion of trends in steel casting industry. Mr. F. Kermit Donaldson, Exec. vice-pres., *Steel Founders' Society of America*, 920 Midland Bldg., Cleveland 15.

Tangent Benders

Story of how tangent benders operate and what they produce is told in illustrated brochure; various models shown with examples of output; also describes production facilities. *Struthers Wells Corps.*, Titusville, Pa.

Tap Driving

Equipment for tap driving including chucks, heavy duty holders, spring compression holders and others are discussed for use in various machines; taper, specification and price charts included in illustrated Folder No. 123-1. *Scully-Jones & Co.*, 1915 S. Rockwell St., Chicago 8.

Timing Device

Circular relates operation and use of "Syncro Timer", remote control timing device to direct, classify or sort travelling material. *Pratt & Whitney Div., Niles-Bement-Pond Co.*, West Hartford 1, Conn.

Tips and Blanks

Catalog Section 60-010 covers specification data and list prices for all grades and sizes of standard, modified standard, semi-standard and modified semi-standard Firthite tips and blanks. Mr. N. W. deBerardinis, Mgr., Sales Prom. and Adv., *Firth Sterling Steel & Carbide Corp.*, McKeesport, Pa.

Valve Control

Engineering and specification sheets for double solenoid 4-way directional control valve (type 89). Widely illustrated with line drawings. *John S. Barnes Corp.*, 177 Walnut St., Rockford, Ill.

Welding, Cast Iron

Bulletin 465 outlines properties, procedure and typical applications of "Ferroweld", for shielded arc welding of cast iron, and "Softweld", for machinable welds in cast iron with d-c or a-c. *Lincoln Electric Co.*, Cleveland 1, Ohio.

Wheel Forming

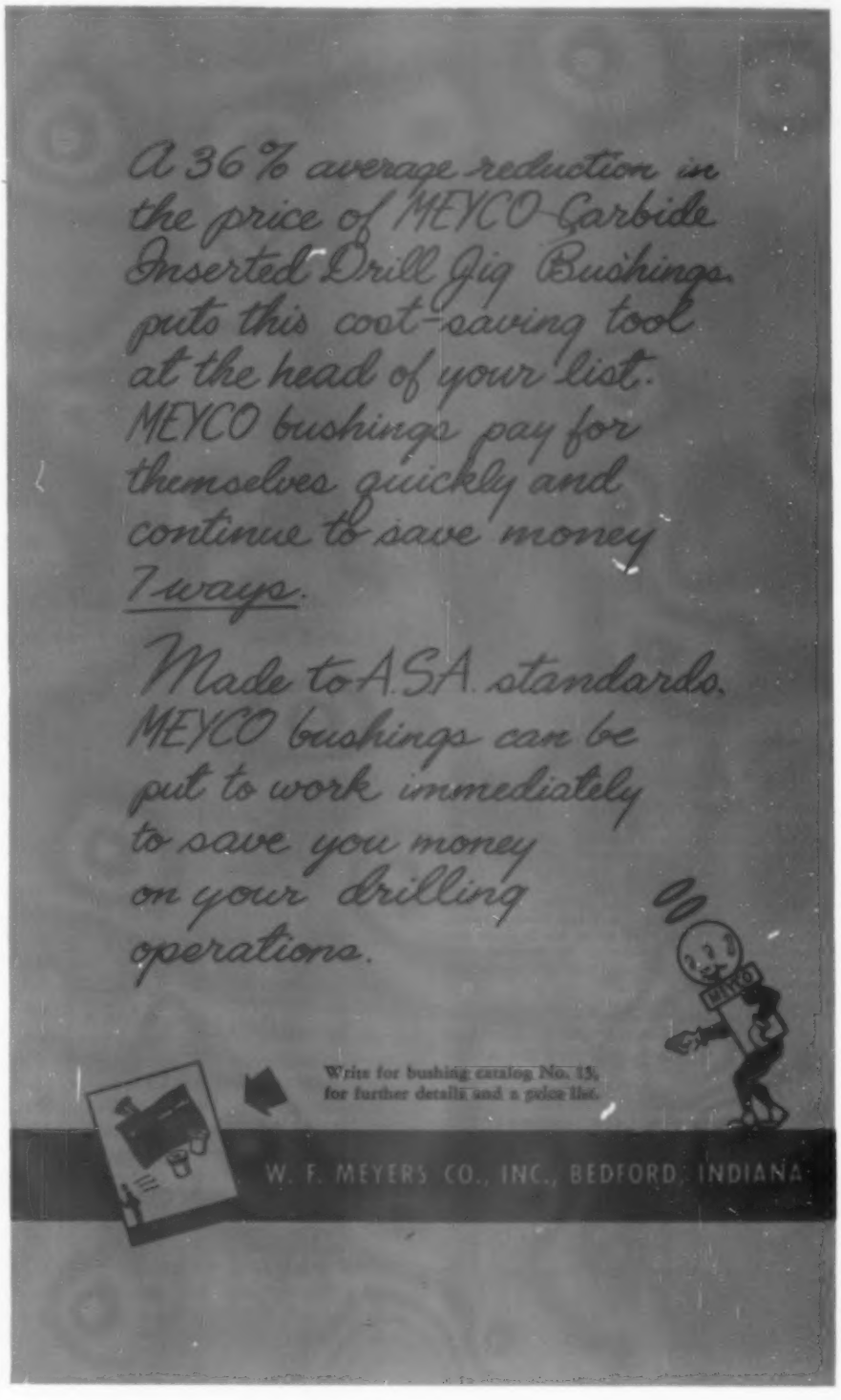
Circular pictures and describes recently introduced Diaform wheel forming attachment for precision dressing of grinding wheels for form grinding in solid hardened steel. *Pratt & Whitney Div., Niles-Bement-Pond Co.*, West Hartford 1, Conn.

Wrenches

Illustrated and alphabetically indexed, 100-page Catalog No. 49 describes line of Vitalloy wrenches and shop tools. Supplementary price lists with listings corresponding to those of first catalog also available from *Billings & Spencer Co.*, Hartford, Conn.

Wrenches

Hundred-page Catalog 49 illustrates line of wrenches and shop tools manufactured by *Billings & Spencer Co.* of Hartford, Conn. Included are data tables, individual page index for quick reference and numerical index with weights and standard packaging for each product.


A 36% average reduction in the price of MEYCO-Carbide Inserted Drill Jig Bushings puts this cost-saving tool at the head of your list.
MEYCO bushings pay for themselves quickly and continue to save money 7 ways.
Made to A.S.A. standards. MEYCO bushings can be put to work immediately to save you money on your drilling operations.
Write for bushing catalog No. 13, for further details and a price list.
W. F. MEYERS CO., INC., BEDFORD, INDIANA

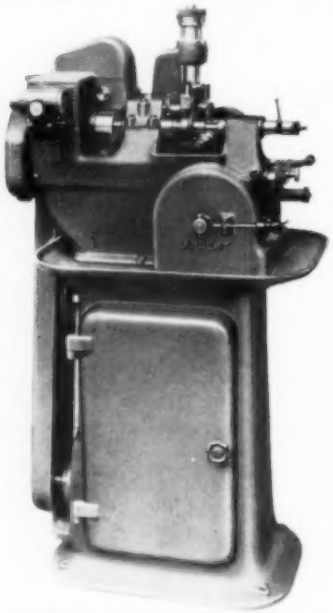
LAMBERT

Increase Gear Production! LAMBERT M75 STEPS UP PRODUCTION 50%

Ideal for the manufacture of precision gears with diameters from .07874 to 3.46456 inches (2 to 88 MM).

- **STRAIGHT TEETH GEARS**
- **HELICAL GEARS up to 18° R.H. or L.H.**
- **WORM WHEELS (cut radially) and with available special attachment**
- **BEVEL GEARS, straight teeth**

Automatic radial and longitudinal feed, combined in the M75, effect a shortened approach stroke . . . increasing productive capacity as much as 50 percent!



- **Cuts gears from 2 to 88 MM.**
- **Maximum Module—1.5**
- **Number of Teeth—4 to 390**
- **Speed of Hobs—214; 380; 550; 940 RPM.**
- **10 Feed Speeds—0.075—0.80 MM.**

Positive, automatic lubrication system for all working parts . . . Coolant pump with easy accessible swarf filter . . . Cutter spindle of solid construction, allows replacement of cutter arbor . . . Work spindle easily removed . . . Comes with deburring attachment; cam for radial hobbing of worm wheels; helical gear hobbing cam; gears for 10 feed speeds; gears for 4 hob driving speeds; etc. . . . Correcting mechanism for highest precision divided gears; attachment for hobbing bevel gears; and extra index gears available as supplemantary equipment.

Write for data on Model 75 and other Lambert gear hobbing machines.

LAMBERT DIVISION

HAUSER

MACHINE TOOL CORP.

MANHASSET, N.Y.

North East West South IN INDUSTRY

William T. Keenan has retired as a district sales manager, mechanical goods division, **United States Rubber Co.**, after 39 years of service with that organization. **Joseph A. Conlon,** formerly assistant district sales manager, has been named to succeed Mr. Keenan.

E. O. Howard has been appointed sales engineer for the Grinder and Titan Abrasive Div., **Charles H. Besly & Co.** Mr. Howard previously had been manager of the company's Buffalo, N. Y., territory.

Recent announcement has been made of the appointment of **Stanley E. Cobbledick** as sales manager of the **Franklin Steel Div., Borg-Warner Corp.**, and of **Samuel W. Cherry** as superintendent of the company's Franklin plant.

Louis R. Ripley

George Perrault, Jr.

Louis R. Ripley has been elected president of the **Heli-Coil Corp.**, Long Island City, N. Y. Prior to his present connection Mr. Ripley was an officer of the Pepsi-Cola Co., and president of the United Cinephone Corp.

George Perrault, Jr. has been appointed sales manager of the rolling mill division of **E. W. Bliss Co.**, Salem, Ohio. Mr. Perrault formerly was sales and advertising manager of the Salem Engineering Co.

S. J. Woodworth has been named sales manager of the Wright Hoist Div., **American Chain & Cable Co., Inc.**, succeeding **A. R. Haskins** who resigned from the company as of October 15 to establish a business in Milwaukee. Mr. Woodworth has been associated with Wright Hoist Division more than 25 years.

The Visi-Trol Corp., manufacturers and distributors of graphic control charts and systems, have moved to a new location at 21460 W. 8 Mile Rd., Detroit 19.

Robert N. Lynch has been promoted to the position of sales manager of Heat Treating Materials Div., **Park Chemical Co.**, Detroit. Mr. Lynch formerly had been working in the capacity of metallurgical sales and service engineer in the company's Michigan-Ohio territory.

Recent appointments announced by Otto G. Schwenk, acting general manager of Stamford Div., **The Yale & Towne Mfg. Co.**, included that of **Richard H. Diesel** and production manager and of **Frank S. Haniewich** as assistant production manager of the division. The appointments are part of a reorganization program now in progress with the Stamford plant.

Francis J. Sehn, formerly chief die engineer for Fisher Body Tank Division, has joined the Detroit office of **Clearing Machine Corp.**, Chicago., as a sales engineer.

A number of changes in the sales organization of **Standard Pressed Steel Co.**, Jenkintown, Pa., includes **George A. Gade** has been named mid-west regional sales manager; **Francis J. Kinsella** succeeds Mr. Gade as Detroit district manager. **David J. Hurford** has been appointed special representative for aircraft products, west coast area, while **William C. Harper,** replaces Mr. Hurford as Cincinnati district manager, and **A. Clayton Graham** assumes Mr. Harper's former post as representative in New England.

The Baldwin Locomotive Works, Philadelphia, has purchased the press business of **Defiance Machine Works, Inc.**, Defiance, Ohio, including all models of Defiance preform presses, now to be manufactured under the Baldwin-Defiance name at the Baldwin Eddystone, Pa., plant.

Coming Meetings

Nov. 28-Dec. 2, American Society of Mechanical Engineers; 70th annual meeting. Statler Hotel, New York.

Jan. 16-19, first Plant Maintenance Show, Auditorium, Cleveland. American Society of Mechanical Engineers and Society for Advancement of Management, are co-sponsors of program to be held concurrently.

Richard H. **Bancroft** has been appointed executive engineer of the **Perfect Circle Corp.** to fill the vacancy made by the retirement of Macy Teetor in 1948. Mr. Bancroft formerly was in charge of the corporation foundry at New Castle, Ind., a position now filled by **Dallas F. Lunsford**, and of the sleeve castings plant at Richmond, Ind., a post now assumed by **Robert C. Myers.**

Earl J. **Mills** has been named manager of **Diamond Alkali Co.'s** southwest sales district including Texas, Oklahoma and Kansas, and **Charles W. Klaus** has been appointed to take charge of Diamond sales activities in the Illinois, Indiana, Iowa, Michigan, Minnesota, Wisconsin and Nebraska area.

Dr. Eugen **Sovegjarto** has joined the staff of **Eutectic Welding Alloys Corp.**, New York City, as consultant and researcher in the developmental program for electrodes for low and high alloy steels, according to Rene D. Wasserman, president of the company. Dr. Sovegjarto previously was employed by metallurgical concerns in Germany.

Wrought Magnesium Corp., subsidiary of **Brooks & Perkins, Inc.**, announces plans for building a new sheet and plate magnesium production plant in the Detroit area. Production of 500,000 pounds of magnesium per month is anticipated from the plant scheduled for operation within a year.

W. Emmett Bittner, former vice president-purchases, **Diamond Alkali Co.**, died recently in Mercy Hospital, Pittsburgh. Mr. Bittner joined the chemical company in 1916 and was elected to his latest post in June of this year.
News in Industry

Dr. **Martin H. Heerin**, formerly director of research for the Armour Research Foundation of Illinois Institute of Technology, has been named director of applied research for industrial products division, **Elgin National Watch Co.** of Aurora, Ill.

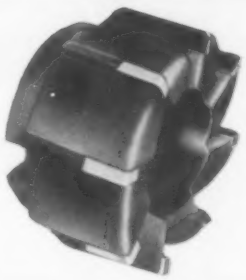
OBITUARY

William C. Briggs, for 33 years a mechanical goods salesman for the Pittsburgh branch, **United States Rubber Co.**, at his home in Columbus, Ohio. He had retired from the company in December, 1945.

Benjamin F. Lambert, manager of coke sales for **Diamond Alkali Co.** since May, 1927, at Glenville Hospital, Cleveland.

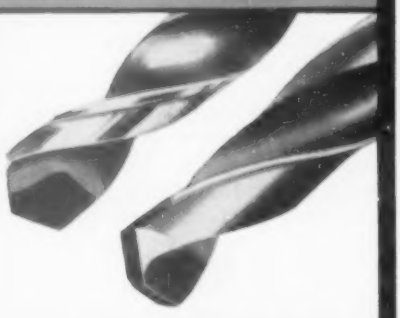
George **Robert York**, former salesman for the **Bullard Company**. He had been associated with the company since 1937.

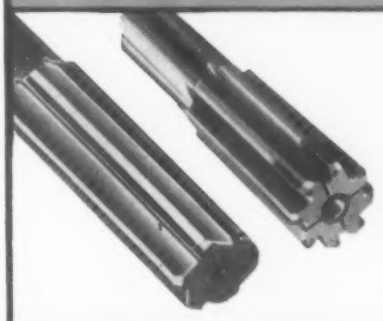
SUPER STANDARDS
Carbide Tipped



MILLING CUTTERS
For side, shell, face, and end milling.

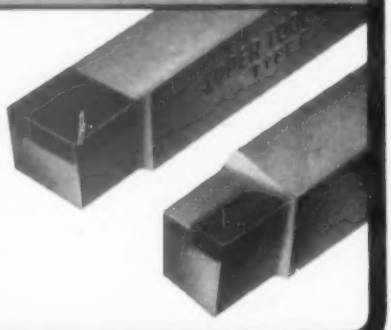
TWIST DRILLS
standard and fast spiral types.





REAMERS
chucking, expansion, jobbers', and shell types.

Turning
Boring
Facing
TOOLS

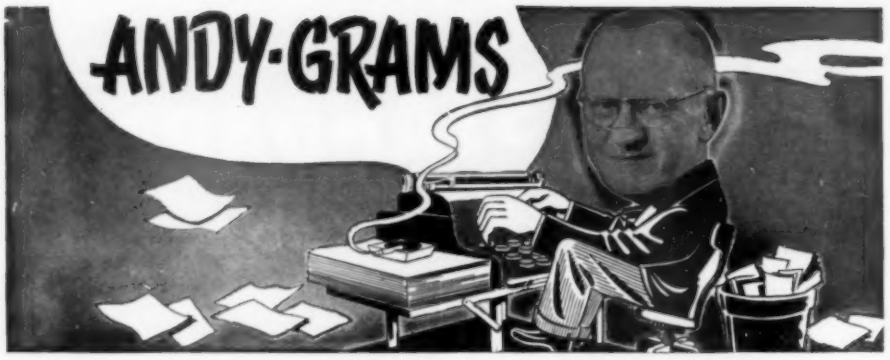


Substantial stocks of above tools, plus Carbide Tipped Counterbores, Saws, Core Drills, Ejector Type Tools, etc., on hand ready for prompt shipments.

Many of your special jobs can be served quickly by altering one of the above standard Super tools. A new catalog ready soon.

SUPER TOOL CO.

21650 Hoover Rd., Detroit 13, Michigan • 5210 San Fernando Rd., Glendale 3, California



Like most tool engineers, it's been my lot to be caught in the middle, with things happening either too soon or too late although, in the long run, it's been all for the best—that is, as far as I'm personally concerned. Like the winter years ago when a stalled street car caused me to miss the Larchmont by a jump I'd have taken but for a heavy suit case. That night, the boat went down to Davy Jones locker, along with most of the passengers. Another time—but skip it. You wouldn't believe it if I told you.

Right now, caught between having been nowhere and the Semi-Annual in Montreal in prospect, I'm faced with the ordeal of trying to say something intelligent or, if not that, at least something interesting. Wotta life! Maybe you boys N.E.W.S. can help me out by having the Column discontinued. Of course, it gives me something to do, but not taking any chances on the popular vote I'll extend Holiday greetings now instead of waiting 'til December.

Now, having sparred for an opening—but hey, I get a break! Detroit's Ch'man Monta Cox just dropped in for a visit, during the course of which he sold me a ticket to No. 1's October meeting at Chevrolet-Detroit Forge. A really swell meeting it turned out to be—almost SRO—with Wks. Mgr. B. D. Marshall as MC. During the pre-dinner handshaking got discussing sacroiliacs with Monta and Bob Ford and it seems everybody's had one or going to have it which makes it no novelty except the way it sneaks up on you.

Despite having spent the biggest part of my life in the plant, I always get a bang out of seeing things flow along a production line, and I was enjoying the plant tour hugely when, of a sudden, I felt a warning twinge—that *sacr*eiliac again—and figured I'd best get out while I could drive home. But how to get back? However, Personnel Director Gene Briggs took care of that, even arranging for a young chap named Jack Reid to drive me to where I was parked. Thanks a million!—and Gene, hang onto that man Jack. He's one fine boy.

I've said this before, and it won't hurt to repeat:—We've heard a lot about soulless corporations, but there just ain't no such thing. In the hectic turmoil of mass production nerves may fray and tempers flare, yet among the people who work there is a warmth and friendliness that manifests itself in a flashing smile, a wave of the hand or an act of innate courtesy. Let's not take those things for granted.

During the dinner, snacked with Andy Carnegie, Ed Beyma and George Bobbish, the latter a right nice guy as he'd have to be to be the permanent flame of ASTE's pin-up Maxine (nee Ericson) Bobbish. Fred Hebert, all winded from the long drive from Romeo, wedged in during the pie course but soon caught up with the rest. Found out he was going to the Scandinavian Symphony concert come Saturday—that is, Oct. 15—which was okay by me since, along with ASTEer Johnny Boe, I was recently made a Director of that Society.

That's all okay as far as Johnny's concerned, him being a musician. But why me I can't understand a/c I can't play the piccolo nohow besides which so many others of our boys—Carl Oxford, George Ringstand, Jens Feldborg, Jimmy Giern among several score—are far better qualified. Must be that indefinable something I've been worrying about all these years.

What I'm leading up to is that any of you boys who enjoy symphony music are cordially welcome to the rest of the season's concerts—Dec. 3, Jan. 28 and March 3, to give you the dates—and the local boys might as well respond a/c they'll meet oodles of their ASTE buddies besides which they'll enjoy the post-concert sociabilty and dancing along with *kaffe och dopp*.

Also, I was made chairman of an art exhibition which, under sponsorship of the Swedish Engineers Society, will be held at the Scarab Club of Detroit December 6 through 15. On the Committee are ASTEers Herman Ortegren, John Markstrum, Henning Freden and Carl Bjorklund; also, Arvid Lundell, prex of Colonial Broach, Valentine Tallberg, engineering administrator at Ford Motor Company, and Martin Westerlund who is also well known in local industrial circles.

On behalf of the Committee, I most cordially invite the entire Detroit Chapter to attend this exhibit—in fact, we'll even set aside an ASTE night—as well as adjacent Ann Arbor, Pontiac and Windsor Chapters. As aforesaid, you'll be most cordially welcome. You know how it is, tool engineers get their hands into lots of things, including music and art.

A casual conversation turning to hospitals, I mentioned where I'd read of a new hospital bed equipped with push buttons which regulate windows, shades and heat, swings a wash basin into position and—of all things!—raises a whatchamaycallit right up through a hole in the mattress. See what I mean by things coming too late in my life?

Now, that's right in line with what I was telling the Peoria boys a while back; never mind these pastel tinted casseroles that they slide under you and which plumb violate the law of gravity besides which you can't read the Sears Roebuck catalog in comfort nohow. Now me, I've been agitating for something in line with natural law all these years, and now they've done it, all of which goes to show that if you beef long enough somebody's going to pay attention. Oh nuuuuurse!

The way inventions are coming along like grist out of a hopper people don't get excited about things any more, not even about the Reds having the atom bomb which doesn't surprise me personally a/c any damphool would know they'd get it sooner or later. At that, it's one thing they can't claim credit for having got there first with. (Is that a split infinitive? Page Doc Edmondson).

Perhaps it may be as well in the long run, because now everybody concerned should think twice before dropping one of those super-duper pineapples in view of practically certain reprisal. The A-bomb will just have to be outlawed unless everybody but the last man is to be wiped out—and what'd he have to live for unless there were also an Eve or a Lilleth? Along with that, we might as well go the whole way and outlaw war as well, one argument just leading to another and settling nothing anyway. As the miller put it: "Eventually, why not now?"

A letter from Jim Walker, now back in Texas and, as I get it, for the moment on the loose. Must be the homing instinct; "east, west, home's best", as the poet said. Well, Jim has plenty of know-how of metal processing and I imagine that by this time one of those progressive Lone Star manufacturers will have grabbed him off. Congratulations to both.

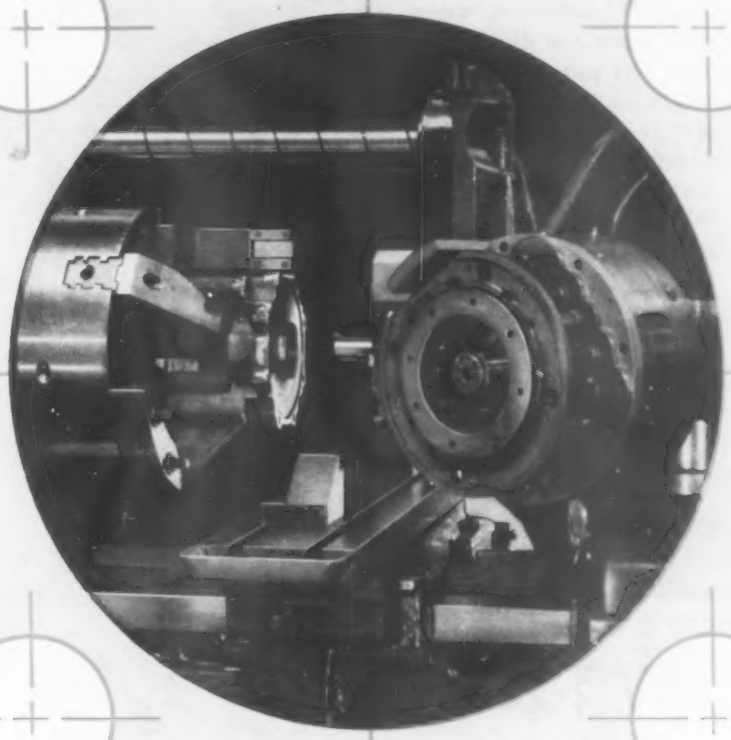
Also a letter from Gadgeteer Fedirico Strasser, down in Chile, commenting on the coincidence(?) of similarity between a gadget recently published in The Tool Engineer and one that appeared in another magazine a year or so ago. But, as I wrote our South American friend, there's really nothing new under the sun in the way of making things; it's just that new people are coming along who haven't seen the old things. That's why we keep building school houses. And that being all for now I am

ASTEely yours

Andy

Sure Way to Avoid Secondary Operations is to tool-up with

P&J TOOLING on the P&J AUTOMATIC



A case in point is *multiple drilling*; the tool that does the trick is the P&J self-driven Multiple Spindle Drill Head. It drills, countersinks or reams any number of holes to precision specifications for size, location and alignment — all in the one holding, as the conventional part of a sequence of high speed, fully automatic chucking and turning. That's P&J Tooling on the P&J Automatic! They team-up together to combine cuts . . . to reduce machining time . . . to eliminate extra work handling . . . to save time and money. Production Tooling Headquarters will engineer your tooling for better work, and more of it at the lowest cost per unit. Get a P&J cost and time estimate, and compare. Simply send sample parts or prints; there's no obligation.

Performance Features of the P&J SELF-DRIVEN MULTIPLE SPINDLE DRILL HEAD

As the turret of the P&J Automatic indexes into exact alignment, the P&J Multiple Spindle Drill Head engages with the work chuck which rotates the Drill Head. The drive is transmitted through gears and pinions to the drills, establishing correct speed ratios to finish the job to perfection in the fastest possible time. Action, including feed, is fully automatic.

Potter & Johnston Company
Pawtucket, R. I.
subsidiary of Pratt & Whitney
Division Niles-Bement-Pond Company

P&J

P&J AUTOMATICS...
tooled for Production - Speed - Economy
at Production Tooling Headquarters

STA·KOOL Diamond Dresser

Tool life, speed of cut, increased production, depend upon the diamond tool. The patented STA-KOOL is provided with water ducts for wet-grinding and cooling fins for dry-grinding, thus keeping stone and setting at safe operating temperatures. STA-KOOL Tools last longer and cut costs from 30 to 50%. Catalog on request.

J. K. SMIT & SONS, INC.

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In Canada: 129 Adelaide St. West, Toronto, Ont.

Statement of Ownership

STATEMENT of the Ownership, Management, Circulation, etc., required by the Acts of Congress of August 24, 1912, and March 3, 1933, of The Tool Engineer, published monthly at Detroit, Michigan, for October 1, 1949.

State of Michigan, County of Wayne—ss.

Before me, a notary in and for the State and County aforesaid, personally appeared Robert B. Powers, who, having been duly sworn according to law, deposes and says that he is the Publisher of The Tool Engineer and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, and business manager are: Publisher, Robert B. Powers, 550 W. Lafayette Blvd., Detroit 26, Mich. Editor, Gilbert P. Muir, 550 W. Lafayette Blvd., Detroit 26, Mich. Production Manager, James Curran, Jr., 550 W. Lafayette Blvd., Detroit 26, Mich.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) American Society of Tool Engineers, Detroit, Mich., R. B. Douglas, Laval Sur Le Lac, Quebec, H. L. Tigges, Toledo, Ohio, W. B. McClellan, Detroit, Mich., G. A. Goodwin, Dayton, Ohio, J. J. Demuth, St. Louis, Mo., H. F. Owen, Lafayette, Ind.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

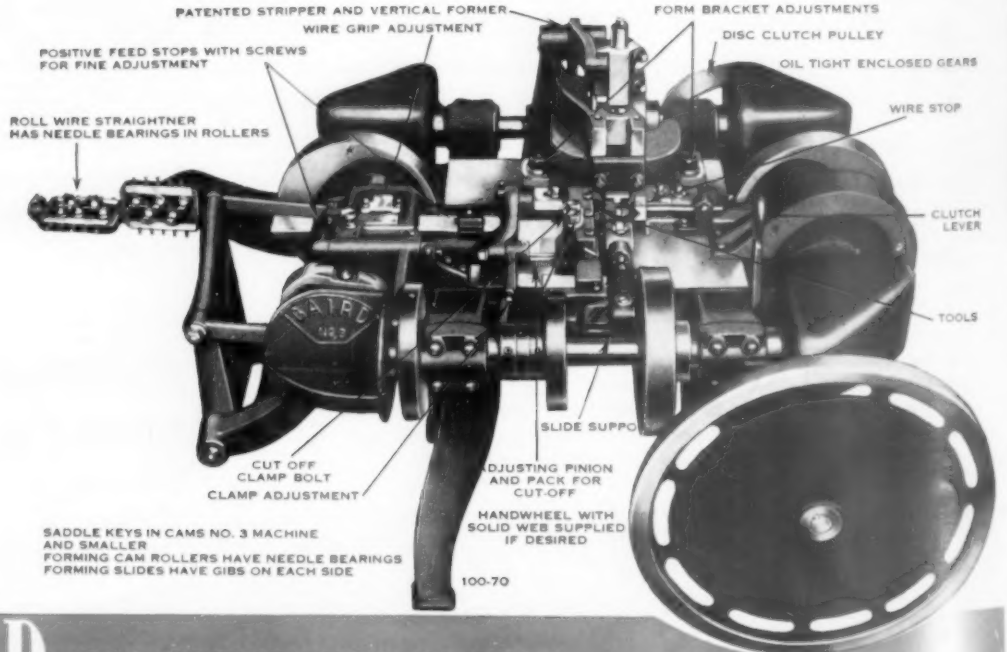
4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is—(This information is required from daily publications only.)

Signature of editor, publisher, business manager, or owner, Robert B. Powers. Sworn to and subscribed before me this 1st day of October, 1949, Doris B. Pratt. My commission expires May 12, 1952.

AUTOMATIC MACHINERY BAIRD STRATFORD CONNECTICUT U.S.A.

WIRE and RIBBON *Metal Forming* MACHINES


PATENTED STRIPPER AND VERTICAL FORMER
WIRE GRIP ADJUSTMENT
FORM BRACKET ADJUSTMENTS
DISC CLUTCH PULLEY
POSITIVE FEED STOPS WITH SCREWS FOR FINE ADJUSTMENT
OIL TIGHT ENCLOSED GEARS
ROLL WIRE STRAIGHTNER HAS NEEDLE BEARINGS IN ROLLERS
WIRE STOP
CLUTCH LEVER
TOOLS
SLIDE SUPPO
CUT OFF CLAMP BOLT
CLAMP ADJUSTMENT
DJUSTING PINION AND PACK FOR CUT-OFF
HANDWHEEL WITH SOLID WEB SUPPLIED IF DESIRED
SADDLE KEYS IN CAMS NO. 3 MACHINE AND SMALLER
FORMING CAM ROLLERS HAVE NEEDLE BEARINGS
FORMING SLIDES HAVE GIBS ON EACH SIDE
100-70

7 SIZES

Send samples of your wire and ribbon metal formations to be made in high production at low cost, for estimate.

ASK BAIRD ABOUT IT

THE BAIRD MACHINE COMPANY STRATFORD, CONNECT T

Baird also makes Automatic Presses, Lathes, Chucking Machs., High Production Machine Tools, Tumbling Machines, A

A BIG BONUS TO YOU

...IN OILGEAR SURFACE BROACHING MACHINES

When you purchase an Oilgear Surface Broaching Machine you get a big bonus of features which are not incorporated in other machines.

Consider these important features carefully for if you don't get Oilgear *features* you can't get Oilgear *performance*.

WIDER SLIDES AND TABLES

Tool slides and shuttle tables on Oilgear machines are up to 130% wider than ordinary. There's ample room for grouping tools and fixtures to broach two or more parts in pairs, sets or sequence on EACH slide. Then too, there's up to 4" more room for LONGER tools because the full stroke of slide can be used for broaching. These features alone multiply production for bigger broaching profits.

LONGER WAYS

Heavy hardened and ground rectangular ways run FULL LENGTH of tool slide stroke to guide the slide for close tolerance broaching. Slides DO NOT run off ways. Close slide and table clearances are retained indefinitely with simple gib and way adjustments. Ways and slides are automatically pressure lubricated each semi-cycle.

TOOLS ARE PULLED . . . NOT PUSHED

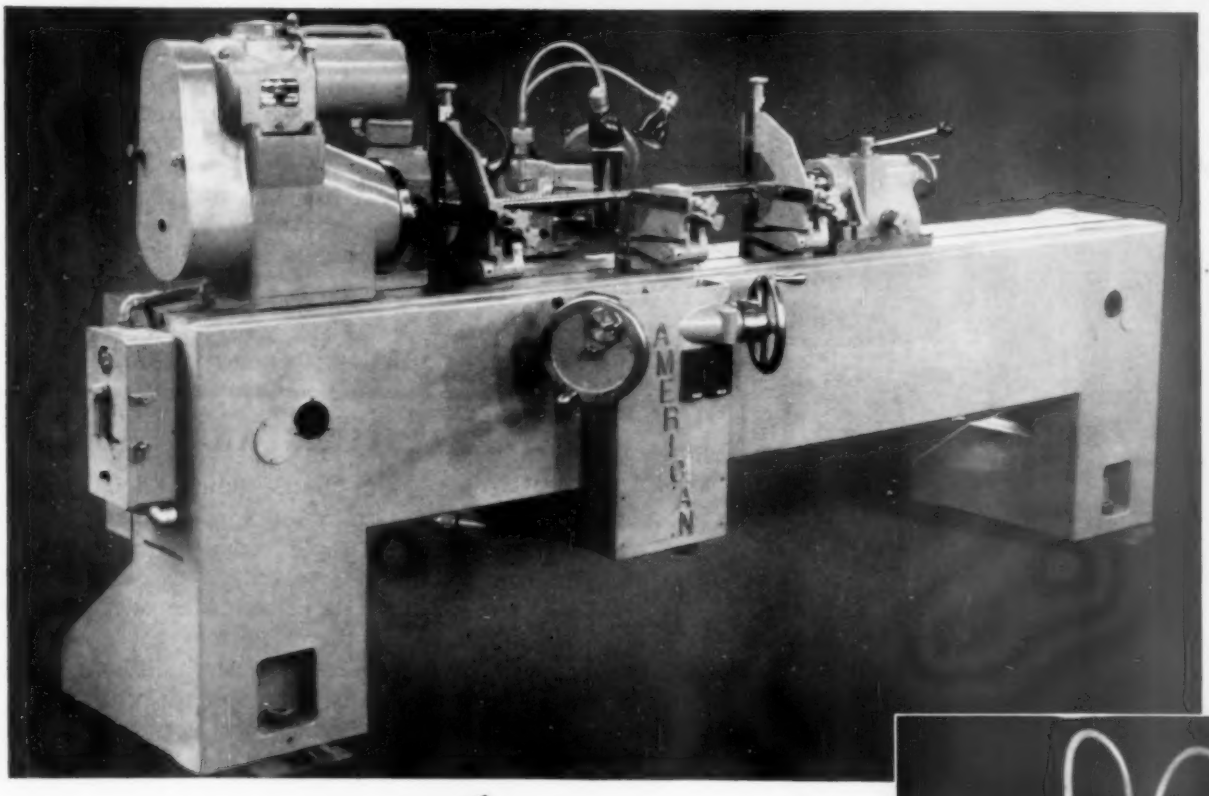
Cylinder ram PULLS slide downward to broach work; ram is in TENSION under broaching load and not in compression. There's no ram DEFLECTION to cause wear on ram, packing and cylinder. Positive delivery of oil to pulling side plus a rigid column of oil on return side gives SMOOTH operation. Then too, you get up to 100% higher return speed and save power with our simple regenerative system.

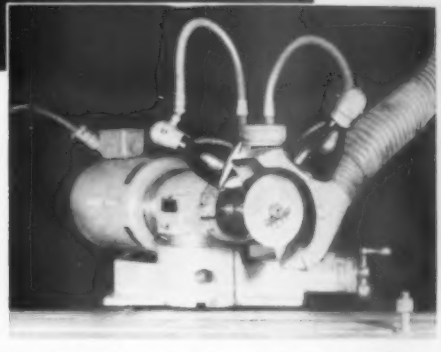
These are only a few of the many exclusive features in Oilgear Fluid Power Variable Speed Broaching Machines Write for complete descriptive bulletins. THE OILGEAR COMPANY, 1573 W. Pierce Street, Milwaukee 4, Wis

Oilgear Fluid Power

BROACHING MACHINES AND BROACHING PRESSES

• Fixed Broach • Traveling Wheel . . . the *American* way to Better Broach Resharpening





Model RSB 9-84 Inset shows grinding spindle.

The NEW *American* ROUND BROACH SHARPENER

Can Give You These Advantages

- **Time Saved Through Faster Resharpening**
- **Money Saved By Fewer Resharpenings**
- **Part Cost Lowered By Better Resharpening**

The new American Round Broach Sharpener is designed to make possible fast, highly accurate broach resharpening in your own plant. It is speedy, efficient, needs no highly skilled operator.

American designed the new RBS to overcome broach vibration which results in an inferior job. **The broach is rotated between fixed centers, while the carriage mounted grinding spindle is traversed from tooth to tooth.**

Here's what you get with this NEW idea:
1. The broach is supported above and between the pedestals. It never extends beyond the bed. This solid support minimizes vibration, improves resharpening. 2. Machine is more durable because there is less wear on vital ways with the ball-bearing mounted carriage always in full contact — never extended. 3. Resharpening is faster, and more accurate because efficient design relieves operator from mental and physical fatigue. 4. Minimum floor space required because no traveling members extend beyond the bed length.

The RBS has been thoroughly tested, for over a year in actual use, in the plant of one of the largest users of broaching in the country. It has proven highly successful. It saves time in broach sharpening, and gives a better sharpening job.

The American Round Broach Sharpener is now available in two models to sharpen cylindrical broaches up to either 60" or 84" in length and up to 9" in diameter.

FEATURES of the *American* Round Broach Sharpener

- Sturdy Construction
- Heavy Ribbed Cast Iron Bed and Pedestals
- Full Between Pedestal Support
- Simple Manual Control
- All Controls Mounted on Carriage
- Cast Aluminum Carriage Ball Bearing Mounted on Hardened and Ground Rails
- Micrometer Dial and Rapid Traverse Lockout on Left Handwheel
- Right Handwheel Controls Infeed
- Variable speed (100-500 RPM) Transmission
- Graduated Face Plate
- Quick Release Variable Tension Spring Loaded Tailstock

Write for complete informative Circular No. 800. Please address Department T.

AMERICAN *American* BROACH & MACHINE CO.
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

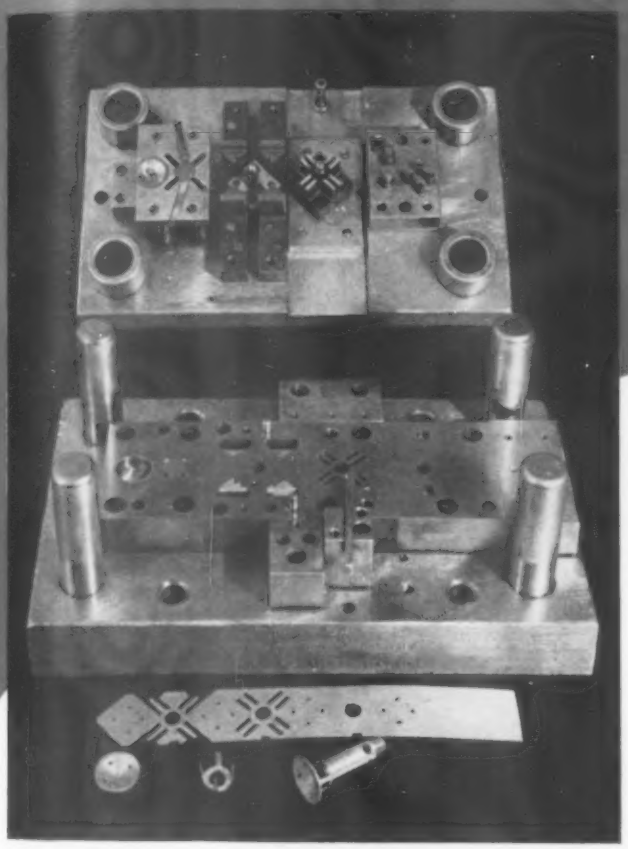
See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

A-H5

(5 PCT CHROME AIR-HARDENING)

A Toolroom Favorite on 5 counts

1. **Air-hardening for safety.**
2. **Good wear-resistance.**
3. **Good toughness.**
4. **Excellent resistance to deformation.**
5. **Easy to machine.**

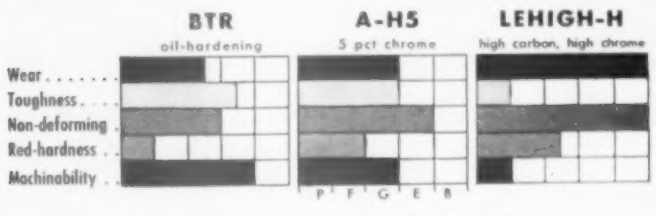


"A-H5 always meets or exceeds our expectations . . ."

This comment comes from the chief engineer of Day and Night Division, Affiliated Gas Equipment, Inc., in Monrovia, California. This company makes a modern line of gas, space and water heaters for home and commercial uses. The die shown is used to pierce, blank and form burner canopies from .0235-in. stainless-steel strip. With all its parts made of A-H5 except the punches (they are Lehigh H), this progressive die is still going strong after producing several hundred thousand pieces, samples of which are shown in the foreground.

There's plenty of versatility in this 5 pct chrome, air-hardening tool steel. And it's economical, too, often replacing more expensive grades.

A-H5 is a general-purpose steel that fits in between the standard oil-hardening steels (such as Bethlehem's BTR) and the high-carbon, high-chrome tool steels like Lehigh H (another Bethlehem champion). Here's a quick comparison of the properties of all three:



(Poor, Fair, Good, Excellent, Best)

Use A-H5 for a variety of dies, punches, blanking tools, cold-forming dies, master tools, gages, and the like. Give it a thorough trial and you'll be sold on having it in your toolroom to stay. Let the nearest Bethlehem sales office or tool-steel distributor give you complete information. Quick delivery from our mill depot or local distributor's stock.

HEAT-TREATMENT OF A-H5

	C	Mn	Cr	Mo	V
Typical Analysis:	1.00	0.60	5.25	1.10	0.25

Annealing: Pack, heat to 1650 F, slow furnace-cool, Brinell 212 max

Preheating: 1200 to 1250 F, prior to hardening

Hardening: 1775 F, air-quench

Tempering: 350 to 400 F, Rockwell C 60 to 62

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation

Export Distributor:
Bethlehem Steel Export Corporation

BETHLEHEM STEEL

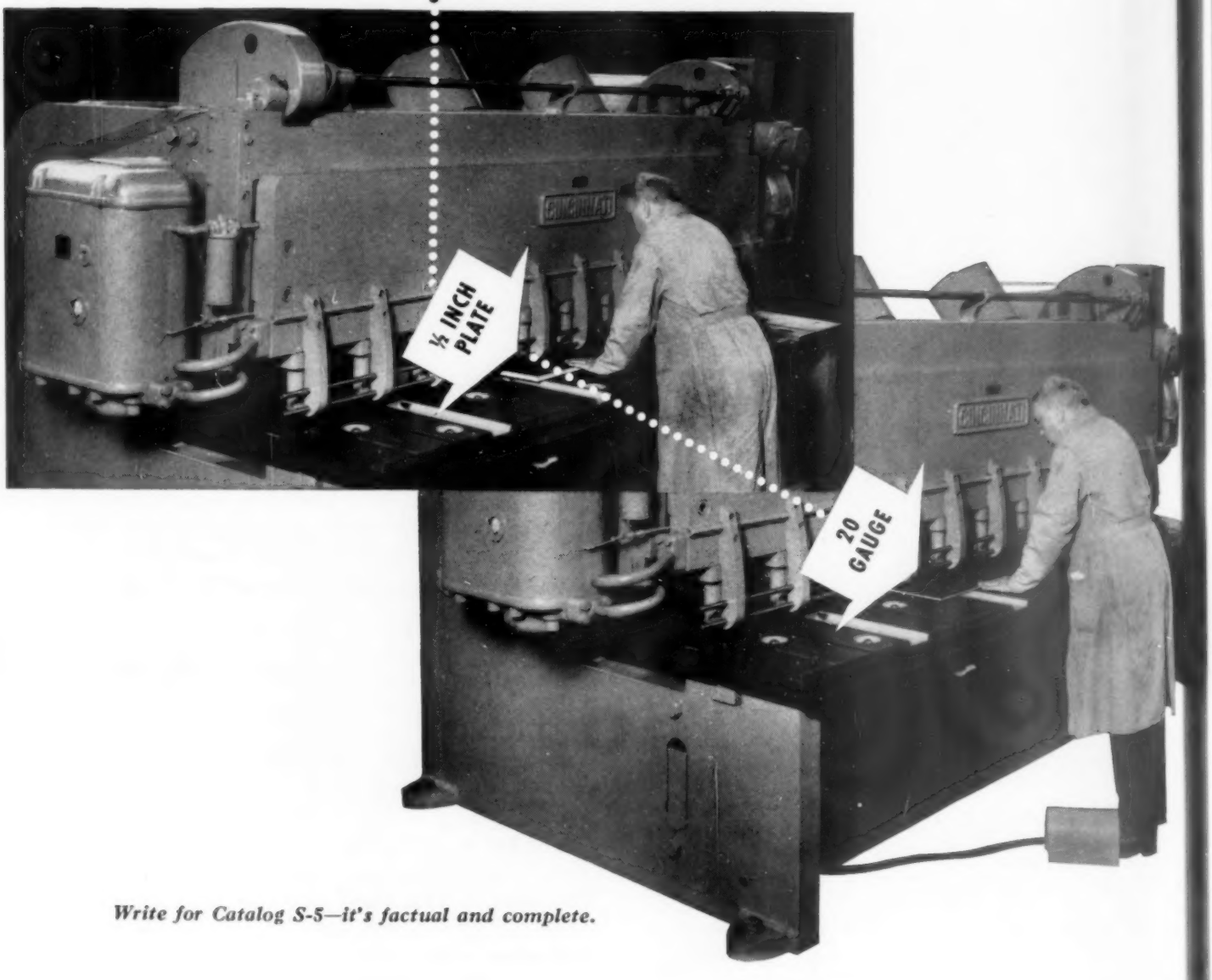
SUPERSONIC TESTED

Bethlehem Tool Steel

SHEAR ½" PLATE OR 20 GAUGE SHEETS

without changing knife clearance

ON A CINCINNATI . . .



Write for Catalog S-5—it's factual and complete.

. . . You do not change knife clearance for successful shearing of different thicknesses on a Cincinnati. Just set the clearance for the thinnest material and shear all thicknesses up to capacity. Thousands of Cincinnati Shears are used continuously in this manner. This practical method prevents accidental damage—saves time. Remember, changing knife clearance interrupts production. Investigate the Cincinnati All-Steel Shear and its accurate, time-saving features.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

POPE

has exactly what you are looking for

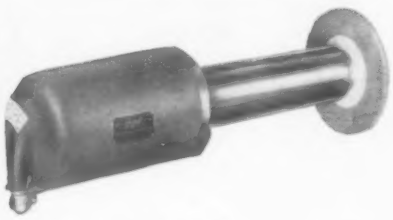
in MOTORIZED PRECISION SPINDLES

Here is a representative showing.

P-2500

POPE Heavy Duty Motorized Spindle for surface grinders, planers, boring mills and other machine tools.
In standard sizes from ¾ HP to 20 HP and from 900 to 3600 RPM.
Available with flange, tapered or special nose for quick mounting of wheels or tools. Ask for Catalog No. 58.

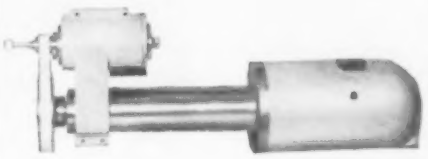
POPE Sealed-In Lubrication



P-32T

POPE Direct Motorized Cartridge Type Spindle for 6" x 18" Surface Grinders and other uses with 1 HP, 3600 RPM totally enclosed motor—a sealed package.

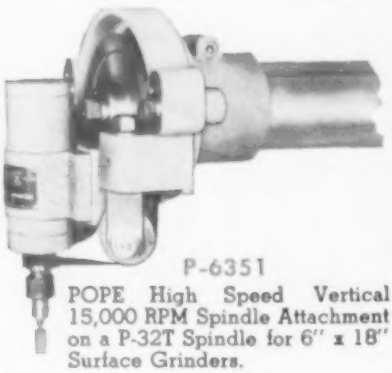
POPE Sealed-In Lubrication



P-6271

POPE High Speed Horizontal 15,000 RPM Spindle Attachment on a P-32T Spindle for 6" x 18" Surface Grinders.

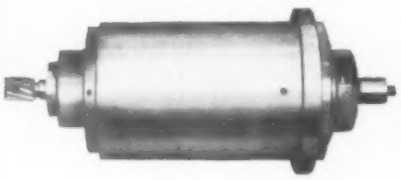
POPE Sealed-In Lubrication



P-6351

POPE High Speed Vertical 15,000 RPM Spindle Attachment on a P-32T Spindle for 6" x 18" Surface Grinders.

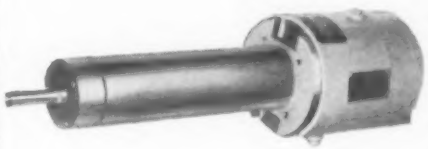
POPE Sealed-In Lubrication



P-5552

POPE Heavy Duty, *High Frequency*, Direct Motorized, Cartridge Type Milling Spindle. 15 HP, 14,400 RPM totally enclosed, water cooled motor, 240 cycles, 3 phase.

Oil Mist Lubrication



P-5681

POPE *High Frequency* Direct Motorized, Cartridge Type Spindle, with 1 HP motor at 7200, 10,800, 14,400 and 21,600 RPM, using 240 and 360 cycle current in combination with a two-pole, four-pole motor.

POPE Sealed-In Lubrication

These Spindles provide you with:

Continuous, Maximum Production . . . Uniformly High Quality Surface Finish . . . Cool Operation at High Speeds . . . *Sealed Lubrication*—no oiling or greasing, nothing to renew, replace or adjust throughout the entire life of the bearings.

No. 64

POPE

TRADE MARK REG. U.S. PAT. OFF.

POPE MACHINERY CORPORATION

ESTABLISHED 1920

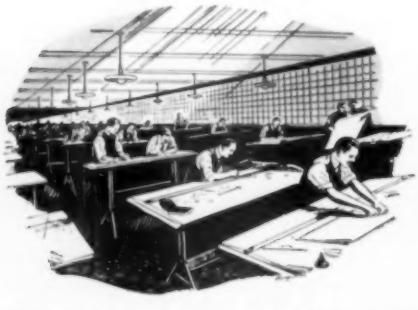
261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES

A note on Abrasives

Improved Abrasive Tools help step up production...cut costs

New production efficiencies and economies are being realized almost daily as a direct result of technical advances in abrasive products. At The Carborundum Company these improvements do not just "happen." They are derived from a carefully formulated program. Product Development... an important activity here... pools specialized knowledge, experience and skill. It probes into the performance of present products... seeks and finds possibilities for doing the job better. It examines and compares the action of bonded and coated products under every conceivable production condition. It studies and restudies technical advances in machines and methods. CARBORUNDUM'S development staff turns up ideas that can be incorporated into new products as well as better ways of using present products. Both are important to production management. As a user of abrasive products by CARBORUNDUM, you receive the direct benefit of all advances in product development. This —together with abrasive engineering and other services—offers another reason for specifying and buying abrasive tools produced by CARBORUNDUM ... the leading name in abrasives. The Carborundum Company, Niagara Falls, New York.



The only complete line of Abrasive Tools is

CARBORUNDUM

TRADE MARK

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

Engineering News
ON ABRASIVE PRODUCTS

Belt Backstand Idler Techniques Effect Operating Cost Reduction

Substantially increased output, lower unit costs and improved finishes are influencing more metal working plants to switch to belt backstand idlers for grinding and finishing flat and contoured surfaces of both small and medium weight pieces. In many factories where set-up wheels were formerly used, conversion from 25 to 100% to the backstand technique has been effected. While these methods normally involve grinding speeds of 6500 to 7000 SFPM with glue-bonded abrasive cloth belts, speeds of 10,000 SFPM are being used widely today with resin bonded belts.

As a result of recent wide-spread experiences with belt backstand idler techniques, our trained staff of engineers is equipped to guide users in making the best use of this equipment. In all cases they are able to recommend applications and abrasive materials to meet your requirements.

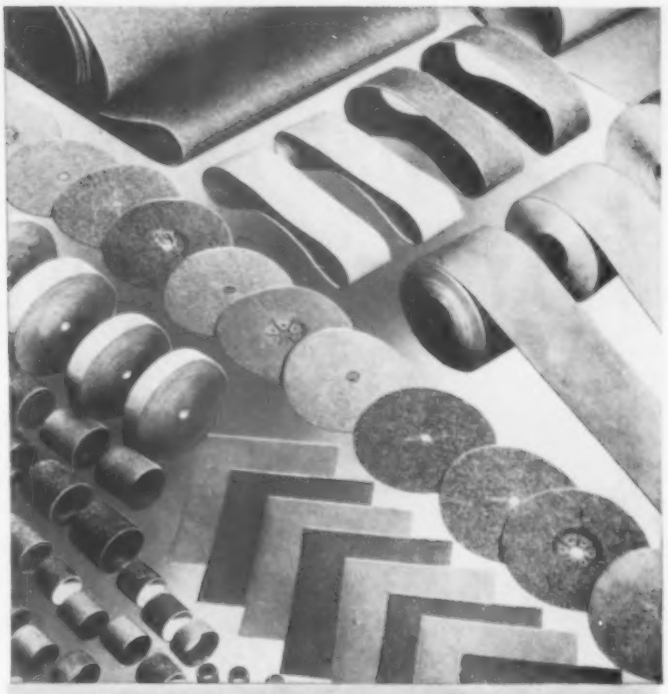
Better Work with Cylindrical and Crankshaft Grinding

Cylindrical grinding wheels including crankshaft wheels by CARBORUNDUM are engineered to provide the tools required for maintenance of efficient production rates, rapid stock removal and fine surface finish.

V11 bond represents the most recent contribution to this class of grinding. These wheels are designed with a *specific structural balance* which when combined with the proper grain size and abrasive type offers the following advantages to both operator and management:

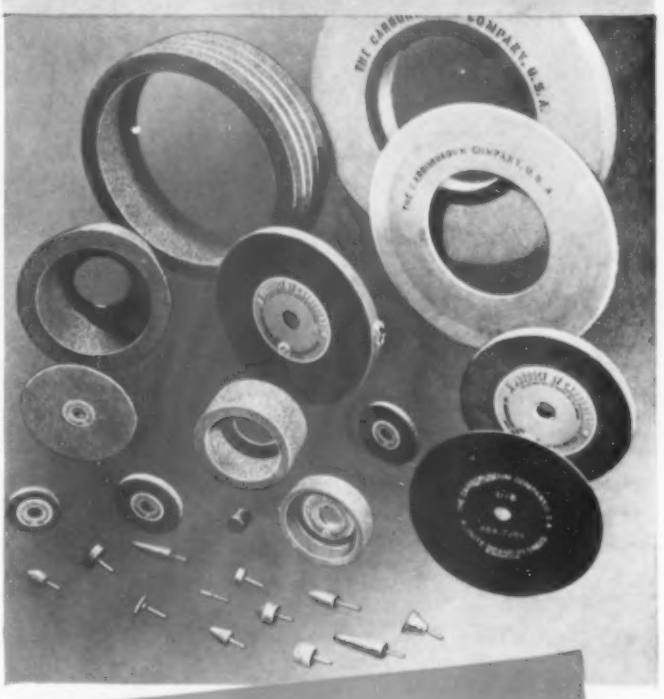
1. Cool and free cutting characteristics promote more efficient production of superior finishes and close tolerances. This is of great importance in operations involving both OD and shoulder or face grinding.
2. Designed structural balance permits continuous fast cutting rates which promote high production.
3. Fast cutting qualities combined with long life save dollars in operator and machine time as well as abrasive costs.
4. Engineered uniformity of the abrasive and bond components of these wheels permits close control of part size and form.
5. Self dressing characteristics provide longer periods of use between dressings . . . save dressing time, usable abrasive and dressing tools.
6. Ability to grind a wide range of materials makes possible savings in inventories of special wheels and minimizes requirements for premium priced abrasives.
7. Savings in set-up time are made possible because the versatility of V11 bond wheels permits efficient grinding of many varieties of work, making it unnecessary to change wheels when changing from one job to another.

For prompt attention to abrasive problems, call your nearest branch office of The Carborundum Company.



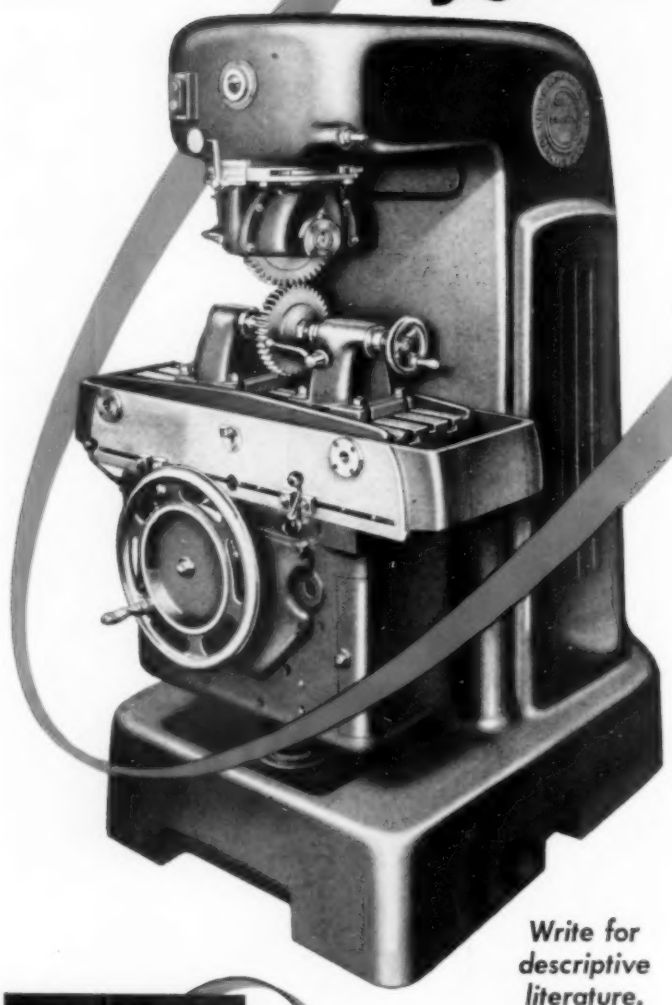
COATED PRODUCTS — SHEETS • ROLLS • BELTS • DISCS SPECIAL SHAPES

BONDED PRODUCTS — ABRASIVE WHEELS • STICKS, STONES AND RUBS • SPECIALTIES • SUPERFINISHING STONES • SPECIAL FORMS • ABRASIVE GRAINS AND FINISHING COMPOUNDS



FOR EVERY ABRASIVE APPLICATION
. . . CALL IN
CARBORUNDUM
TRADE MARK

SHAVING ASSURES BETTER GEARS AT A GREATER OVER-ALL *Production Economy*



This gear shaving machine, the first of its kind, was introduced 16 years ago to fulfill the urgent need of gear manufacturers for a means of correcting precision gears and gears produced to operate under critical loads and speeds—these corrections to bring them within required tolerances.

Today, it is being used by all the leading manufacturers in the automotive industry, the majority of gear jobbing shops and nearly all the machine tool builders.

One gear manufacturer says shaving has reduced rejects which formerly amounted to about 50% to none. Another says that shaved gears have cut operating power requirements approximately 20%.

Gear shaving eliminates the need for skilled machinists, regardless of the degree of precision required. Accuracy does not depend on the shaving machine operator. Shaving also makes it easier to turn out acceptable gears. The teeth of shaved gears have uniform accuracy and the characteristics of all the gears in any lot will be uniform.

Write for descriptive literature.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

NATIONAL BROACH AND MACHINE CO.
5600 ST. JEAN • • • • • • • • • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Want to cut costs on parts like these?

Broaching has cut costs on every one of these parts, as on many hundreds of others, reducing floor-to-floor time, cutting idle time of machines and operators for tool changes, improving accuracy and maintaining it. It's really remarkable how little time Colonial broaching equipment takes to pay for itself.

PIONEERS OF H.S.S. BROACHING

COLONIAL

BROACH CO. DETROIT 13

Have a Colonial Representative check over your parts for ways and means to cut costs by broaching. Write or wire now, before you forget it.

PRECISION MACHINES **PARKER • MAJESTIC**

Since 1907, the name of Parker has been a part of the progress of the automobile industry.

In 1915, Parker introduced the basic principle of ball bearings in grinding manufacture—a major advance in grinding which was unknown at that time.

A few years later the Parker Ball Bearing was patented to meet high speed and precision requirements and has been in use ever since.

Further research and engineering development brought forth the well-known Parker Majestic External and Internal Grinding Machines, each machine representing a great advance in simplicity of operation and precision.

The latest tooling development of the company is the Parker Majestic No. 2 Surface Grinder that provides new accuracy and flexibility for small grinding operations.

These many products of Parker Majestic will continue to serve the great automotive industry in the future, keeping pace with its demands for speed, accuracy and dependability.

MANUFACTURED BY

MAJESTIC TOOL AND MANUFACTURING COMPANY

147 JOS CAMPAU • DETROIT 7, MICHIGAN

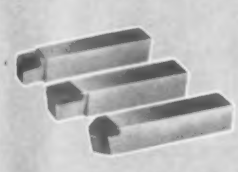
25 times longer life

Talide
(TUNGSTEN CARBIDE)

Centerless Blades

TALIDE METAL MEETS EVERY REQUIREMENT

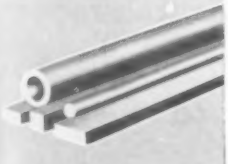
DRAWING DIES



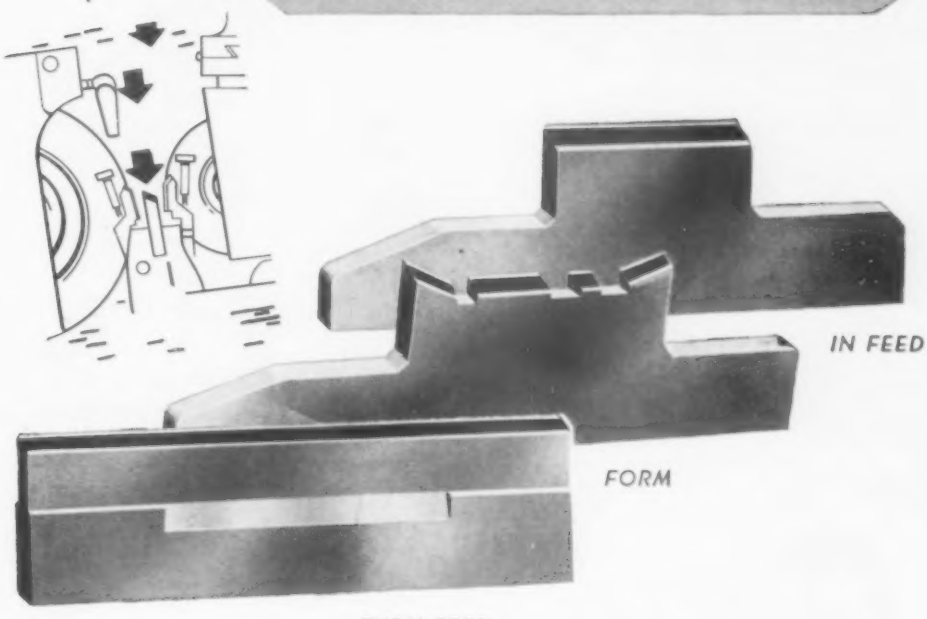
CUTTING TOOLS

DRILL JIG BUSHINGS

ROLLING MILL WORK ROLLS



SOLID BAR STOCK



● Talide Tungsten Carbide Blades outwear cast iron, tool steel or hard-faced blades by at least 25 to 1. On most applications, Talide stays on the job 50 to 75 times longer than other blades.

This longer service life means continuous operation with the advantages of less scrap, less down time and lower unit cost. Remember, too, the Talide Carbide insert is a solid strip without sections or lines or seams to score the work. In addition to standard blades, we design and manufacture form or step blades for use in grinding parts with multiple diameters, steps, tapers, contours or other special shapes. *Forward part or drawing for estimate.*

Talide Blades and other standard Talide products (tools, dies, etc.) are available from stock from the following warehouses:

Newark, N. J., 166 Bloomfield Ave.
Youngstown, Ohio, 107 E. Indianola Ave.
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★ For the full story on longer service life of Talide Centerless Blades, ask for Catalog 48-WP, complete with prices, sizes and specifications.

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METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

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SPECIAL CUTTING TOOLS MADE PROMPTLY...

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CARBIDE TIPPED OR H.S. STEEL

Special cutting tools of all types are a specialty at Detroit Reamer & Tool Company. All carbide-tipped tools are supplied with high speed steel bodies.

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Mfrs. of Special High Speed Cutting Tools

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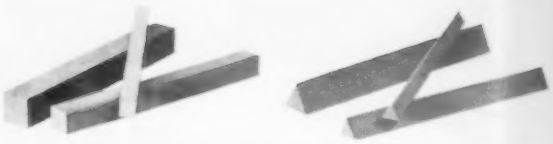

Over 100 standard sizes and shapes to choose from . . .

NORTON® *abrasives*

OILSTONE FILES

Here are the right files to touch up a cutting tool, smooth off the burrs on a gear or fit a die. INDIA® and HARD ARKANSAS Oilstone Files are shaped to conform to work contours and are *all* file instead of rows of individual teeth. Select the ones you need from the Oilstone File Bulletin. Send for it today.

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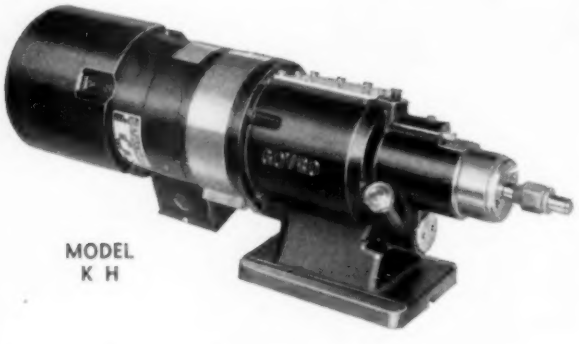

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New!

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DRILLING UNIT

with Full Hydraulic Control

1. Positive hydraulic control.
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4. External adjustment for length of stroke.
5. Completely automatic with remote electrical controls.
6. Mechanism runs in oil, with ball bearing suspension.
7. Simple external adjustments permit use on full range of drill sizes with minimum set-up time.

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Machinists for Precision Parts for 26 Years

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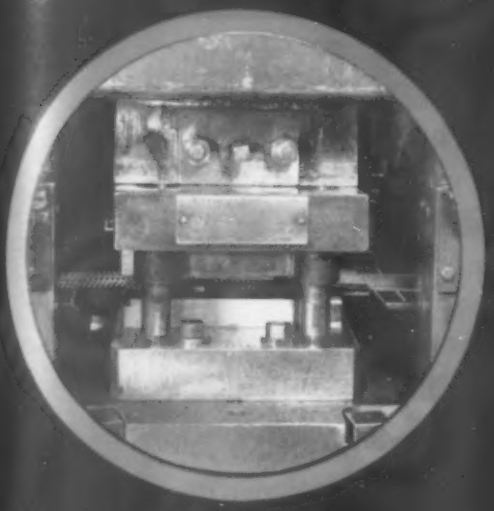
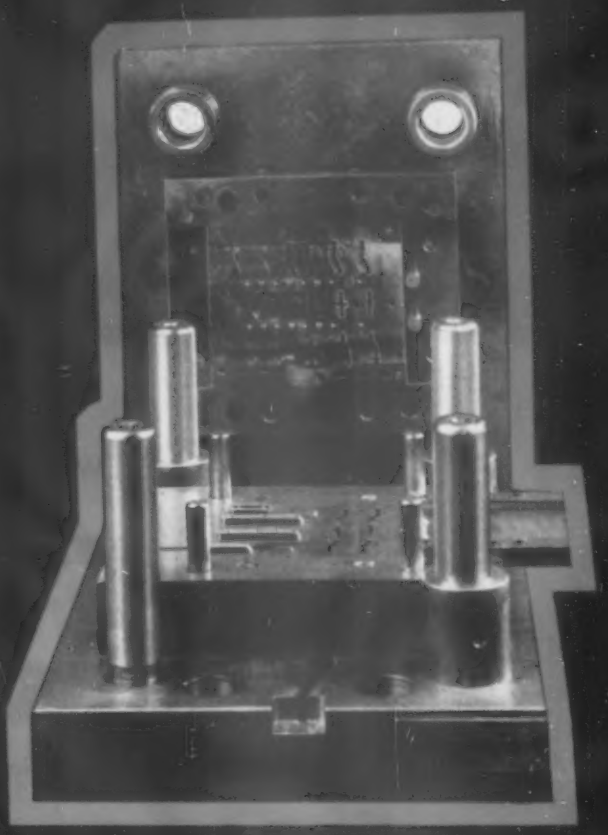
Automatic DRILLING UNIT

Long range stamping program protected with

DANLY
PRECISION DIE SETS



Close-up view of the die installation in the press. Continuously fed strip stock can be seen passing through the die, emerging at the left in processed form.



A Danly Precision Die Set protects the functioning accuracy of this complex die . . . at 160 strokes a minute.

WESTERN ELECTRIC SCHEDULES 75,000,000 PARTS FROM THESE TOOLS . . . AT 300,000 PARTS PER GRIND!

These dies made at the Hawthorne Works of the Western Electric Company are an example of a tough, complicated job of die making that pays off in terms of quantity production. Eight progressive stages change the coil stock into the finished stamping—"contacts" for step by step dial telephone equipment. One set of dies and one press do work which would otherwise take several setups.

To maintain the required close clearances between punch and die, this important set of dies is protected by a Danly Die Set. This prevents premature tool wear and objectionable burring—an important consideration where parts receive no final finishing.

Safeguard Future Production

Only when the diemaker's precision is completely safeguarded by the die set can future production be predicted. Long range scheduling is necessary in the Electrical Industry where the output of contacts, switches, laminations and like parts number into millions. Quantity lots are standard—long range production from a set of dies must be counted on.

Danly Precision Die Sets are one important reason why customers can get the maximum number of parts per grind and can accurately predict total production. That's why it pays off to specify "Danly Precision" on Standard or Special Sets.

Send for this Free Booklet

to see how Danly's special die set machining service can cut your costs still further.

Write to . . .

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Over 25 years of dependable service to the stamping industry

NOW you can obtain L&I quality and service

in a full range of sizes in
the following types of high speed steel
including **LARGER SIZES**

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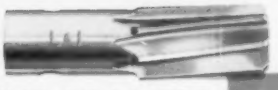

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Taper Shank — Straight and Spiral Flutes — 1/4" to 1-1/2"

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Straight Shank — Straight Flutes
Spiral Flutes 1/16" to 5/16" — 1/16" to 1-1/2"

Taper Shank — Straight Flutes — 1/4" to 1-1/2"

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HELICAL DIE MAKERS' REAMERS — AAA to

CENTER REAMERS Fluted Type

1/4" to 3"

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GROUND L&I *Reamers*

LONGER TOOL LIFE
CLOSER ACCURACY
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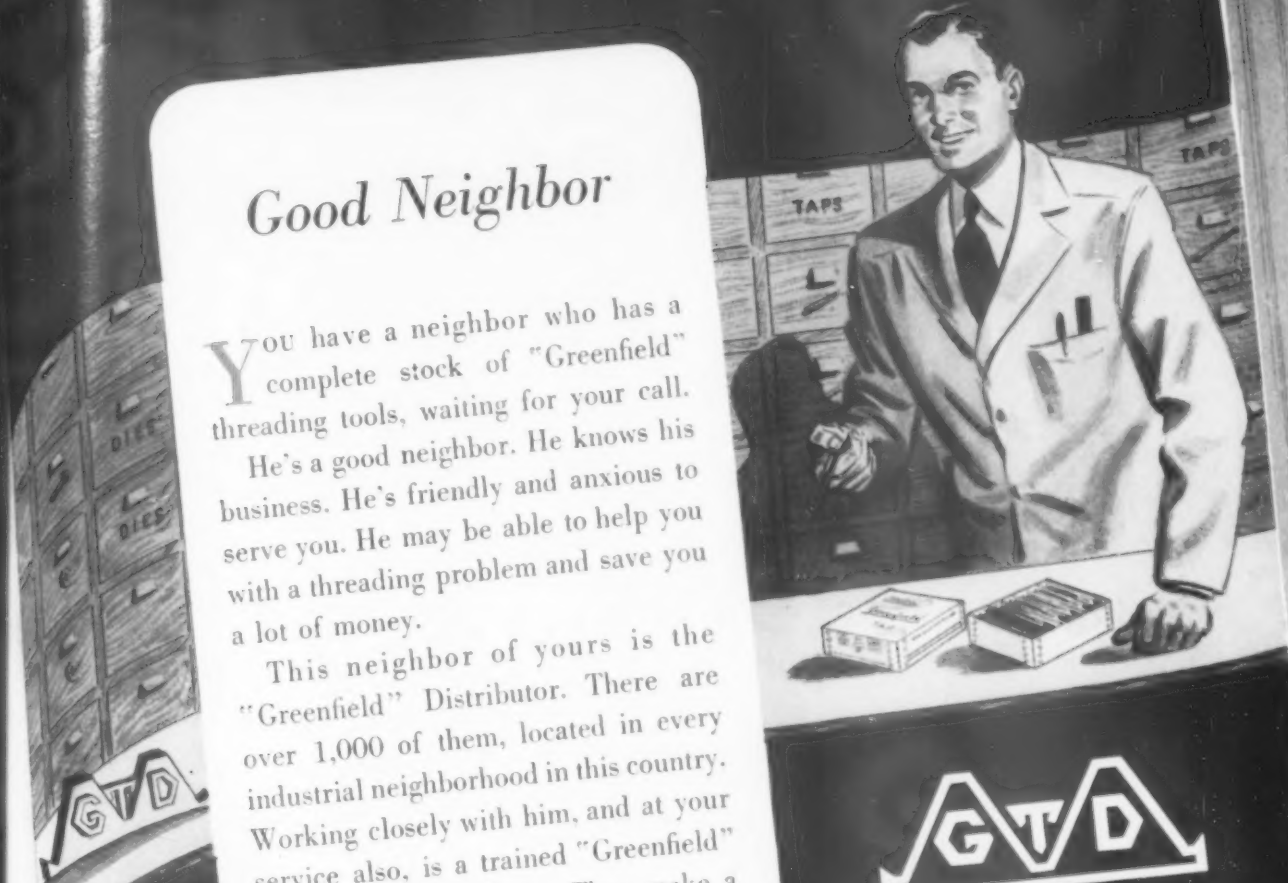
of Service and Quality



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You have a neighbor who has a complete stock of "Greenfield" threading tools, waiting for your call.

He's a good neighbor. He knows his business. He's friendly and anxious to serve you. He may be able to help you with a threading problem and save you a lot of money.

This neighbor of yours is the "Greenfield" Distributor. There are over 1,000 of them, located in every industrial neighborhood in this country. Working closely with him, and at your service also, is a trained "Greenfield" threading tool engineer. They make a team of good neighbors that have been serving American industry, in war and in peace, for over 75 years.

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AMPCO TWIST DRILL CORP. ★
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Divisions of Greenfield Tap and Die Corporation

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Be Sure
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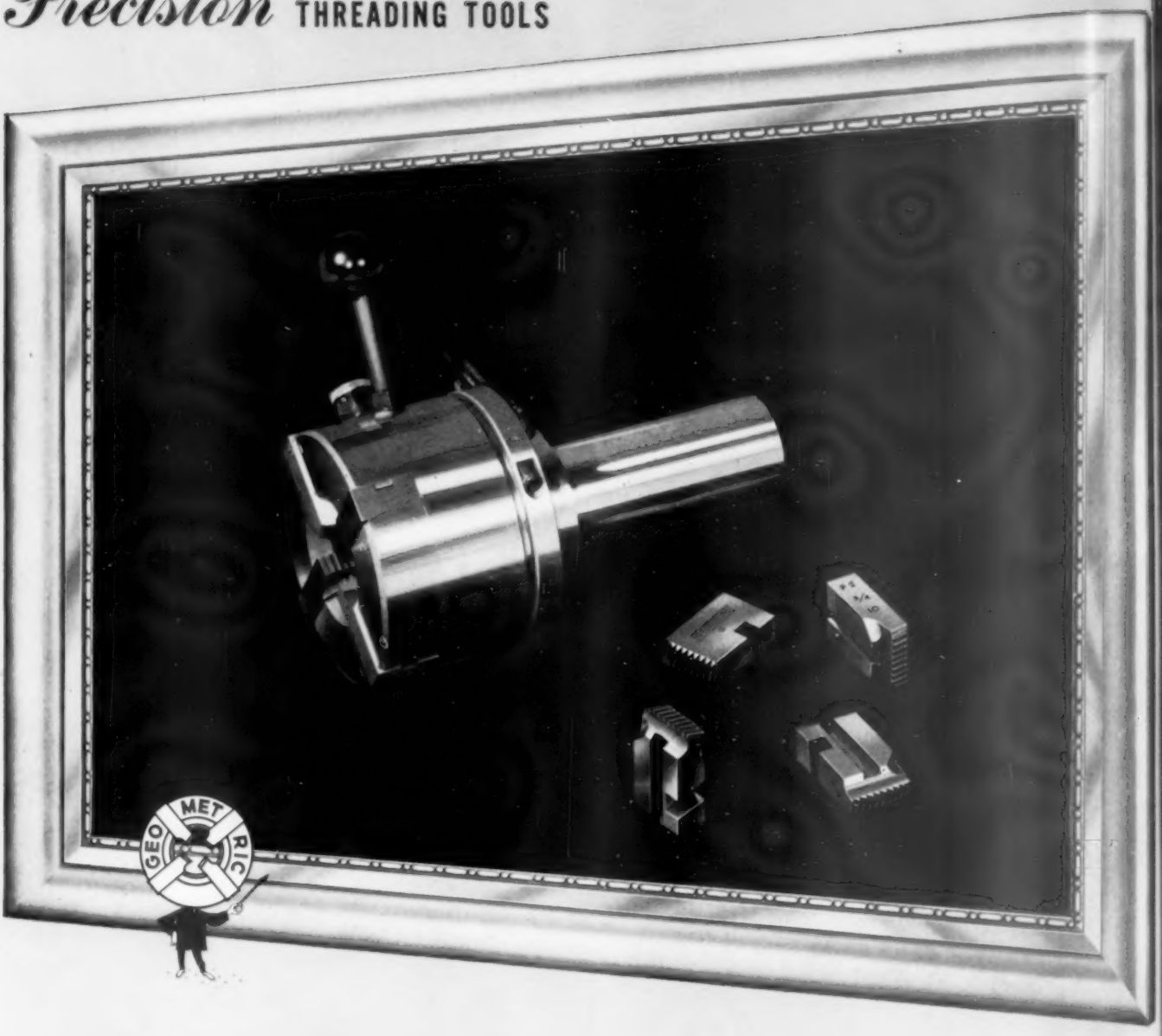
*Since July 1, the operations of Ampco Twist Drill Corporation have been merged with Greenfield Tap and Die Corporation at Greenfield, Mass.

Precision THREADING TOOLS



Self Opening Style D Die Head and Chasers

A heavy duty die head of the stationary type which will cut National Coarse, National Fine and National Pipe Threads. Can be used for finer pitches.

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Available in seven sizes with a cutting range of ⅛" to 2½" diameter.

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GEOMETRIC also makes a complete line of Rotary and Stationary Self Opening . . . and Solid Adjustable Die Heads—Collapsing . . . and Solid Adjustable Taps—and GEOMETRIC Chasers.

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for multiple spindle machines

by SJ SCULLY-JONES

7 COST CUTTING advantages!

YOU GET **IMMEDIATE DELIVERY** of these **NEW** "QUICK-LOCK" ADJUSTABLE ADAPTER ASSEMBLIES FROM **STOCK.**

No thread damage. Set screw does not touch threads.

Stronger, low cost Adapter body. No milled slots.

Your initial cost, set-up time, replacement costs and other economy factors were considered in the design and manufacture of these *New* Scully-Jones "Quick-Lock" Adjustable Adapter Assemblies, that give you seven money-saving benefits.

1. **LOW INITIAL COST.** Savings in manufacturing costs, which we effected by eliminating 4 milled slots in adapter body, are passed along to you.
2. **REDUCE YOUR SET-UP TIME.** Quickly adjusted friction-type nut, locks instantly *any place* on adapter threads.
3. **CUT DOWN YOUR REPLACEMENT PURCHASES.** Last longer; no milled slots to weaken adapter body; no thread damage with *New* "Quick-Lock" Nut.
4. **REDUCE YOUR REJECTS.** National Acme Threads assure accurate fit. Squareness of top face of nut to threads, prevents distortion.
5. **END GUESSWORK ON FINE ADJUSTMENTS.** The "Quick-Lock" Nut is calibrated in steps of .001" for infinitely fine adjustments.
6. **WORK ON CLOSE CENTERS.** Small diameter of nut permits use on Spindles operating on close centers.
7. **MEET ALL YOUR REQUIREMENTS.** Available in wide range of sizes to fit all popular Multiple Spindles.

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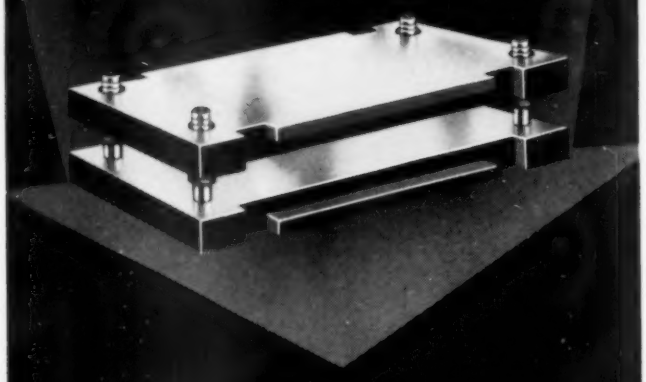
Finely Made Special Die Sets



Our production facilities are employed *exclusively* in the design and fabrication of standard and special steel and semi-steel die sets. "DETROIT" specialization guarantees dependable, prompt service and workmanship of the highest quality on both standard and special jobs. "DETROIT" die sets are Micrometric machined to assure long die life and consistently satisfactory operation.

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DETROIT DIE SETS ★

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PLAIN INDEX CENTERS
Can Be Used on ANY Milling Machine

Kempsmith Plain Index Centers for production and general indexing . . . simplify job set-ups . . . relieve the operator of the necessity of counting or making any calculations. Indispensable in milling taps, reamers, small gears, sprocket wheels, special grooving, etc. Described in Bulletin No. 124.

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KEMPSMITH ARBORS
In all popular sizes or types. Adaptable to ANY make of milling machine with standardized spindle.

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M-T FIXTURE CLAMPS AND COMPONENTS

BE DOUBLY SURE with M-T QUALITY

FIXTURE CLAMPS — wide range of sizes and types to fit every requirement.

Jack Locks . . . Cam Locks . . . Hand Knobs . . . Hand Wheels . . . Steel Ball Handles . . . Soft Chuck Jaw Blanks . . . Fixture Cams . . . Alloy Set-up Studs . . . Rest Buttons and Rest Pads . . . Spherical and Plain Collar Nuts . . . Quarter Turn Screws . . . Fixture Keys . . . Spherical and Flat Washers . . . Shoulder Screws and many other items from stock.

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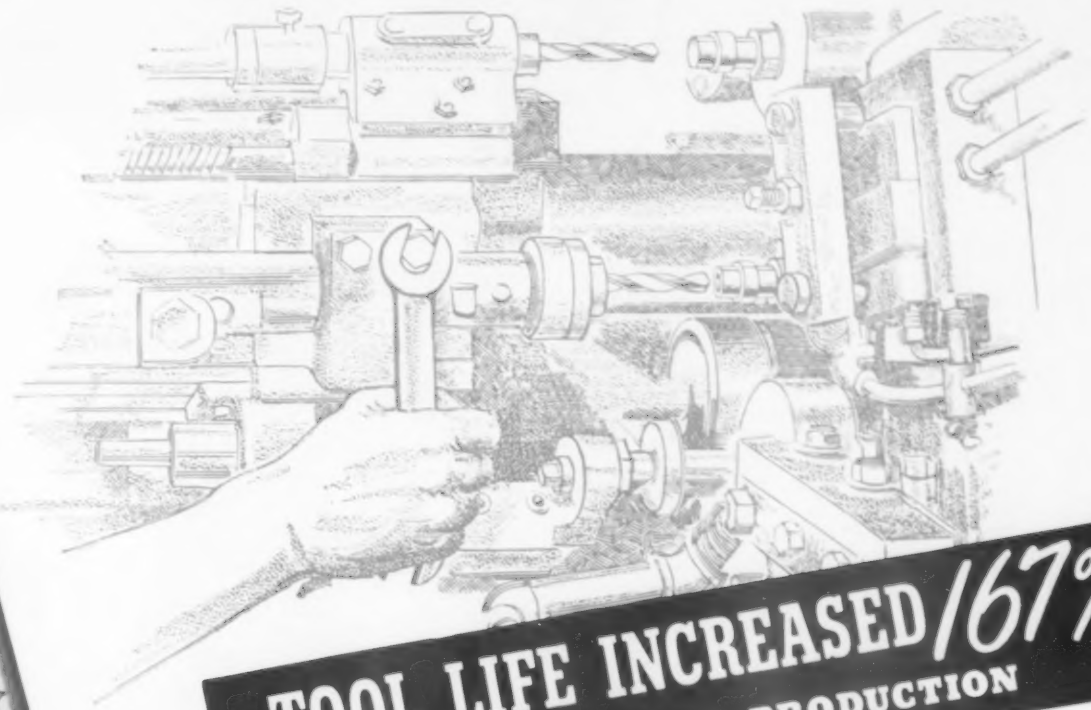

TOOL LIFE INCREASED 167%
. . . WITH 8% MORE PRODUCTION

by using Cleveland drills at correct feed and speed

For best results in automatic screw machines, you naturally choose the finest, most durable tools—such as the CLE-FORGE High Speed Drill shown here. But this alone is not enough. ◈ A few months ago one of our Service Representatives was making a survey in a customer's plant. On a six-spindle automatic he reduced the speed from 1740 to 1566 r.p.m. and increased the feed from .0035 to .0042 f.p.r. Result: Drill life jumped from 1½ hours *to 4 hours.* ◈ A ***Cleveland*** Service Representative may be able to effect similar savings for *you.* Contact our nearest Stockroom, or . . .

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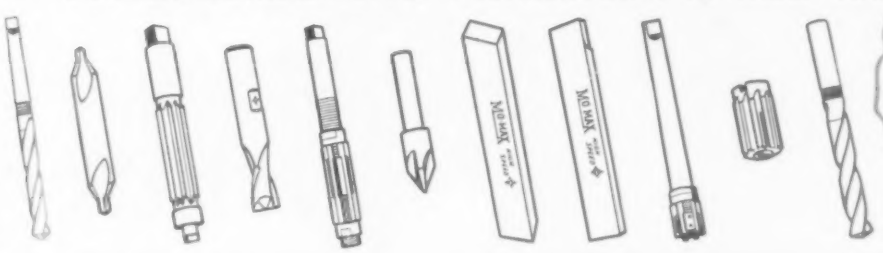
ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER *Cleveland* TOOLS



And
Gear
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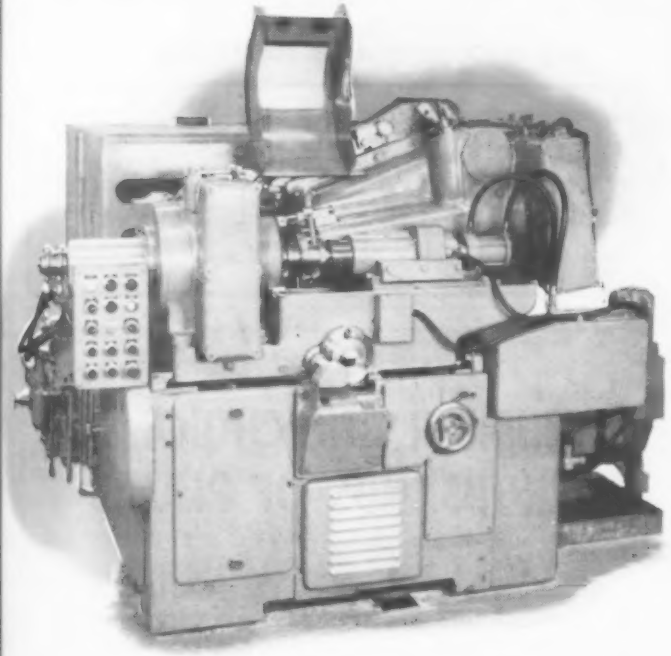
now comes

Finishing—

by a New FELLOWS Process...



New Fellows No. 12 Gear Finisher for external spur and helical gears up to 12½ inches pitch diameter.

1 Gear shaving by a new principle employing a free-cutting tool that avoids burnishing

2 Cutters sharpened in your own plant by a simple face grinding operation

3 Both sides of teeth finished in one cutter traverse... Fast action, full-automatic cycling

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Write or telephone the nearest Fellows office for machine data, production time estimates, etc.

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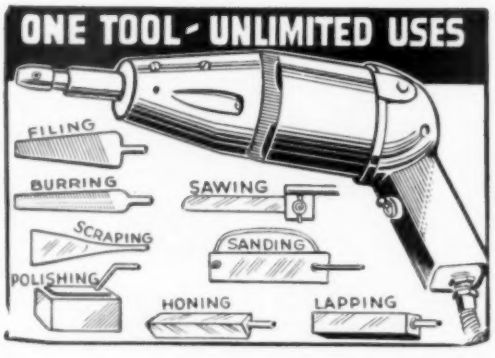
Reduce Your Hand Finishing Time

With RECIPROCATING ACTION TOOLS

Portable Electric



Easy to operate . . . They reach into those hard-to-get-at places . . . Work quickly, accurately and uniformly . . . Deliver either 1/8" or 3/8" long fixed stroke at 1000 strokes per minute . . . Light in weight . . . Operate on 110 volts AC or DC current.

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Use MEEHANITE METAL TOOLS

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Accuracy of your products depends on the accuracy of Checking Tools. Our tools are built to meet your exacting requirements. Equip your Tool Room, Inspection and Production Departments with these MEEHANITE METAL TOOLS.

WE RESCRAPE SURFACE PLATES LIKE NEW

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ACME TOOL COMPANY

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PROMPT DELIVERY

NUMBER ONE CHOICE IN THOUSANDS OF PLANTS

There must be a reason why GORHAM is the number one preference in thousands of industrial plants. More and more manufacturers are turning to GORHAM High Speed Steel Tool Bits for all their cutting tool needs. This superior product has won its reputation through *performance* . . . by meeting the most exacting requirements on tough production jobs. ★ ★ ★ Try GORHAM High Speed Steel Tool Bits in *your* plant today. Learn why these tools do your work better, faster, and at lower cost. Immediate delivery—place your order now.

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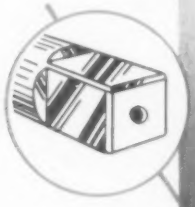
STOP "WOBBLE" WORRIES

with the New and Finer "FORTY-NINER"

BESLY TAPS

"Tru-Square" Driver Stops Tap Wobble—Yet Fits "Free" in all Chucks and Holders



Oversized holes and ruined threads caused by taps with out-of-square drivers or eccentric shanks are a thing of the past when Besly "Forty-Niner" Taps are on the job. New automatic precision equipment—much of which is *exclusive* with Besly—guarantees consistent accuracy of driver and shank on *every* Besly production tap through:

1. **POSITIVE CONTROL** of square dimensions to *.002"*. Correct, "free" fit and solid grip in all chucks and holders is assured.
2. **ABSOLUTE CONCENTRICITY** maintained between shank and axis. Tap "wobble" is eliminated;

This is just one of many reasons why Besly "Forty-Niner" Taps give maximum tapping efficiency. You'll find the same superior accuracy at *all* vital points—as shown at the right.

Add to this, Besly's *faster* delivery, expert tap engineering counsel and service by fully qualified distributors and you have a combination that can give you *accurate threading at the lowest possible cost*. Call your Besly distributor today for a *free* performance test that will prove it.

BESLY'S "HELPING HAND" HAS 5 STRONG FINGERS

- **Fast Delivery**
  —24 hrs. on high speed specials from hardened blanks;
  —3 weeks on bar stock specials.
- **A Complete Line**
- **Top Tap Quality**
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UNSURPASSED ACCURACY at *all* vital points

Microcentric CHAMFER

Micro finish, concentric to tenths of thousandths. Cuts freely and to size without burring or welding.

Solid Ground THREAD FORM

For angle and lead accuracy, elimination of gauging problems and control of pitch diameter to tenths of thousandths. Ground from the solid.

"Right" ROCKWELL

Taps pre-inspected for correct Rockwell hardness.

Mirror Finish FLUTES

Correctly designed to provide freer chip flow and longer tap life.

Tru-Square DRIVER

Square and shank fit correctly in chucks and holders, no wobble to cause oversize holes.

THIS TRADE MARK IDENTIFIES THE WORLD'S MOST ACCURATE TAP

BESLY

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CHARLES H. BESLY & COMPANY, 118-124 N. Clinton Street, Chicago 6, Illinois
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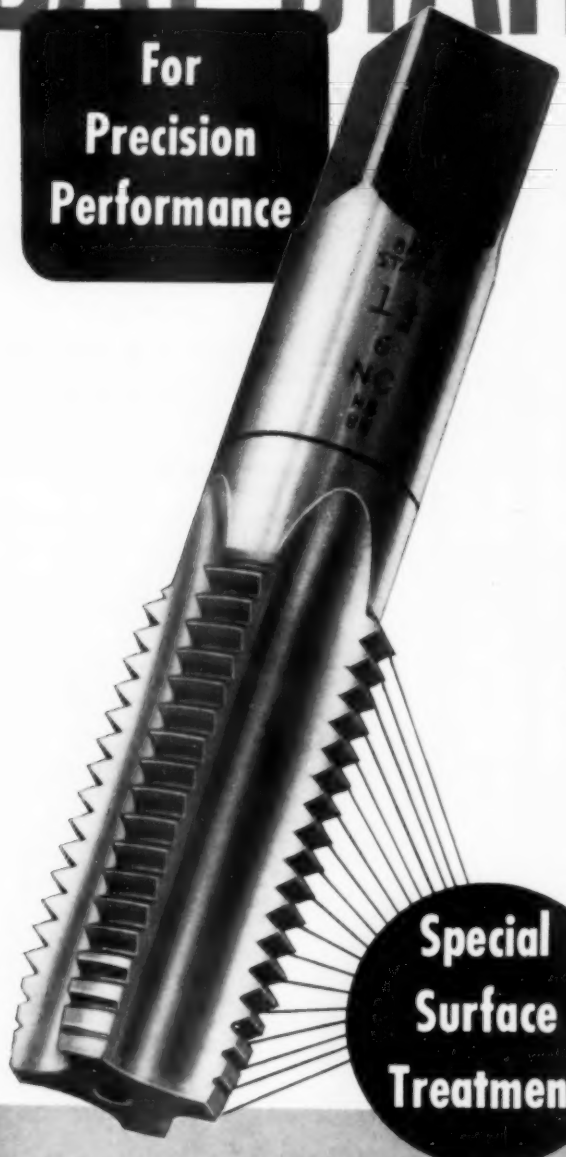
BAY STATE

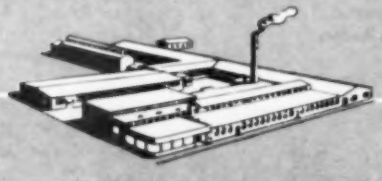
For Precision Performance



Special Surface Treatment

Another reason why Bay State taps produce so many holes, and still cut close to size.

ON THE NEARBY SHELVES OF INDUSTRIAL SUPPLY DISTRIBUTORS



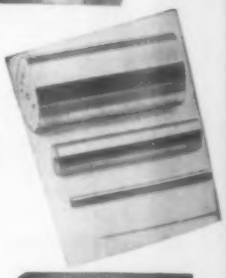
BAY STATE TAP & DIE CO.

MANSFIELD, MASSACHUSETTS

Van Keuren THREAD MEASURING WIRES

STANDARD EQUIPMENT EVERYWHERE

Van Keuren Measuring Wires are the accepted standard equipment for making pitch diameter measurements of taps, thread gages, precision threaded parts, hobs, worms, splines and gears. Reputable manufacturers of ground taps and thread gages used for the production and acceptance of threaded holes and nuts use Van Keuren Measuring Wires. You will seldom find them in error if you, too, have Van Keuren Measuring Wires.



Catalog and Handbook No. 34

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It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

THE Van Keuren CO., 174 Waltham St., Watertown, Mass.

30th YEAR

Light Wave Equipment ● Light Wave Micrometers ● Gage Blocks ● Taper Insert Plug Gages ● Wire Type Plug Gages ● Measuring Wires ● Thread Measuring Wires ● Gear Measuring System ● Shop Triangles ● Carboloy Measuring Wires ● Carboloy Plug Gages.

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"LET'S CALL IN COLUMBIA"

The majority of our new accounts come to us because of need for help and as a result of a satisfied user's recommendation.

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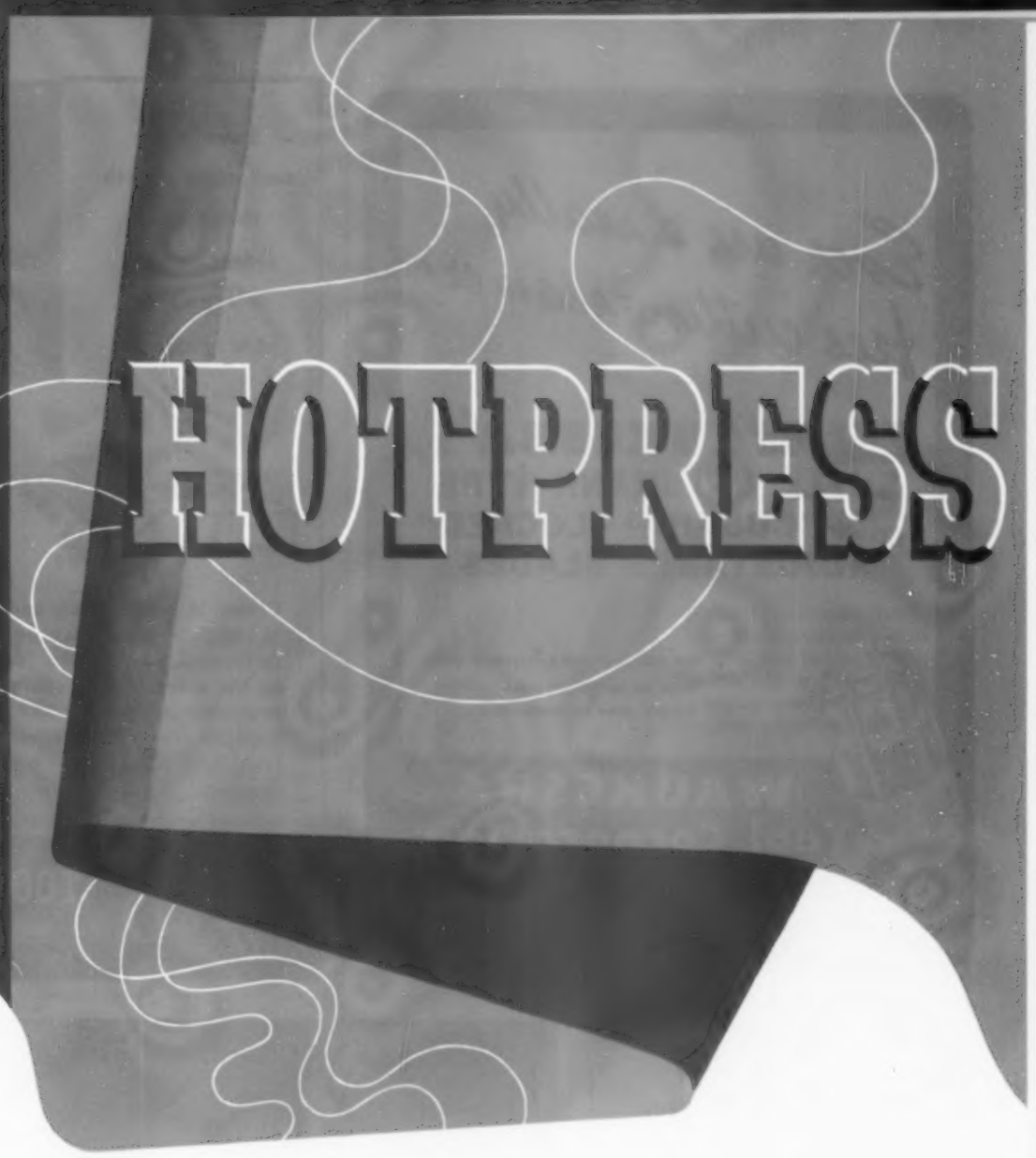
920 EAST 14TH STREET • CHICAGO HEIGHTS, ILL.

First Quality Tungsten Die Steel for hot work



Famous for resisting high temperatures without checking or cracking . . . widely used in hot press forming of steel and brass

This low carbon, high tungsten steel *stands up* under dull red heat in severe die applications. It is fine for dies and dummy blocks in rod and tube extrusion . . . excellent in upsetter machine service . . . and tops for dies for hot forming brass and steel on presses. HOTPRESS is a good steel to know and use. Let us arrange an introduction!

Other First Quality Die Steels for Hot Work

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CHOICE
MARVEL
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FIRST QUALITY TOOL STEELS

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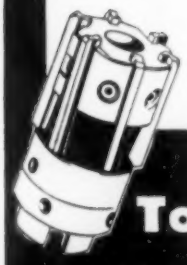
Colonial Steel Division — Anchor Drawn Steel Co.

Ever use a really free cutting reamer?

TRY WAUKESHA'S SHELL OR SHANK TYPE *with* "CUSHION - LOCKED" ADJUSTABLE BLADES



For standard and heavy-duty work
Sizes up to 6½" in stock
Larger sizes on application

WAUKESHA Tool Corporation

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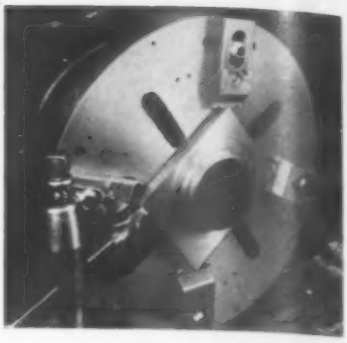
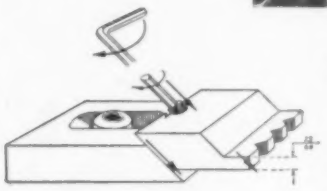
Save time and money with these new side-gripping self locking jaw clamps





J&S Jaw Clamps hold all sizes and shapes of work-pieces tightly against face plates of machine tools. Clamp is self-locking and full surface of work ⅜" high or over may be machined without interference, because the jaws grip the work-piece on the sides. These clamps facilitate controlled centering adjustment—secondary operations are unnecessary — they eliminate different length studs and blockings — tested for two-ton down pressure. Send for details.

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STEEL FLOOR GRATINGS — Production line assembly methods are made practical by portable "Hy-Power" riveters designed to reach hard-to-get-at rivets.

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HYDRAULIC TORQUE CONVERTERS — This 17½-ton Hannifin stationary riveter is used in fabricating runner assemblies for hydraulic couplings.

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AIR CYLINDERS • HYDRAULIC CYLINDERS
HYDRAULIC PRESSES • PNEUMATIC PRESSES
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HANNIFIN "Hy-Power" RIVETERS

IT PAYS TO SPEND MONEY FOR COST-CUTTING EQUIPMENT!

Eliminate Tool Damage and Operator Fatigue

with This Screw Driving Combination

● Suspend a Keller Screw Driver over the work area with the new Keller Balancer and you'll have a convenient working team. Driver can be brought to the job quickly and effortlessly from its suspended position. Accidental dropping and mishandling are eliminated. When the screw driving operation is completed, release the tool, which returns immediately to its "over-the-work" position where it is out of the way but within easy reach.

Portable tools weighing up to ten pounds can be suspended by the new Balancer. It's adjustable to all tool types. Light weight . . . only 5¾ lb. You'll find the Balancer assures longer damage-free tool life, relieves operator fatigue, speeds production.

Straight Handle Positive Clutch

Lever on straight handle controls power and gripping of tool in one action. Positive clutch assures definite engagement of bit and screw. Sizes for all operations.

Short Head Cushion Clutch

High speed for production assembly. Cushion clutch permits screws to be driven to uniform, definite torque, independent of pressure applied to tool. A size for every need.

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Pneumatic Tools

KELLER TOOLS

KELLER TOOL COMPANY, GRAND HAVEN, MICHIGAN

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because . . .

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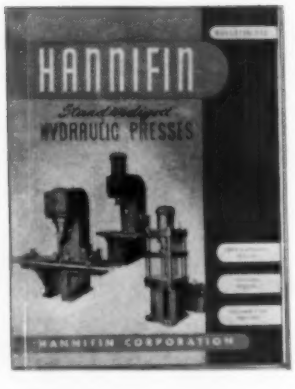
to help you

CUT PRODUCTION COSTS



• Get your copy of this catalog! It contains detailed information on the design and construction of Hannifin's Standardized Hydraulic Presses together with specifications and dimensions for 75 different standard model presses. Ask for Bulletin No. 130.

CUT production costs and boost plant output—you can do it with Hannifin "JOB-TESTED" Hydraulic Presses! Hannifin offers standard and special types of presses for every purpose: straightening . . . press-fit assembling . . . forming . . . molding—in capacities up to 150 tons. Built in a wide variety of open gap and column styles, complete with motor-driven pump and all necessary gauges and controls. Standardized designs for earlier delivery, lower cost. Quality construction for low maintenance, long life.

Everything you want for better, more accurate, more convenient operating control! Hannifin's exclusive Sensitive Pressure Type, or arranged to meet the requirements of the operation.

If you need presses in a hurry, see your local Hannifin representatives or write for complete information and recommendations.

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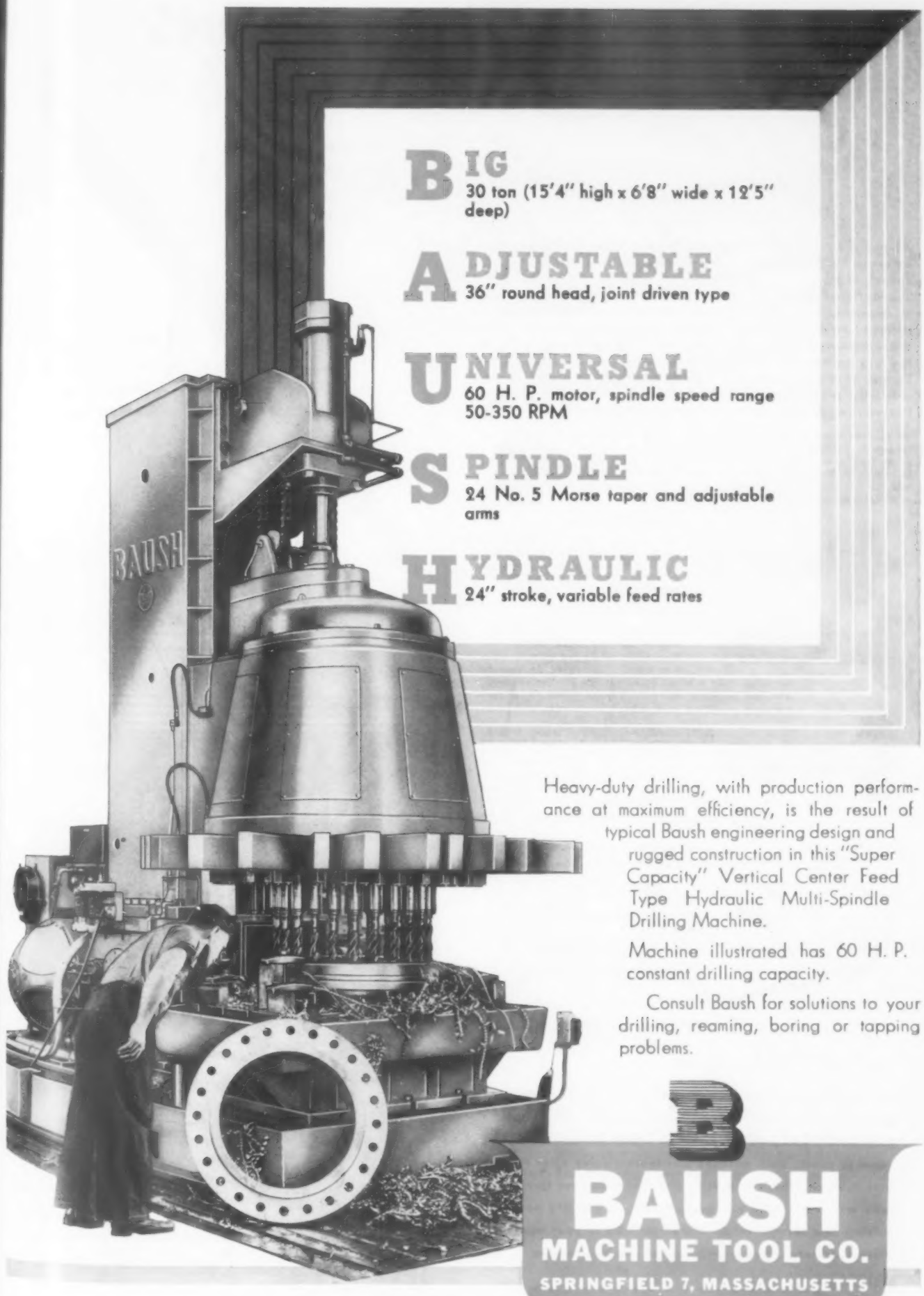
PNEUMATIC PRESSES • HYDRAULIC RIVETERS • AIR CONTROL VALVES

ONE OF MANY DIFFERENT TYPES

75 ton Hannifin forcing press with built-in hydraulic power unit and *"Sensitive Pressure Control."*



BIG
30 ton (15'4" high x 6'8" wide x 12'5" deep)

ADJUSTABLE
36" round head, joint driven type

UNIVERSAL
60 H. P. motor, spindle speed range 50-350 RPM

SPINDLE
24 No. 5 Morse taper and adjustable arms

HYDRAULIC
24" stroke, variable feed rates

Heavy-duty drilling, with production performance at maximum efficiency, is the result of typical Baush engineering design and rugged construction in this "Super Capacity" Vertical Center Feed Type Hydraulic Multi-Spindle Drilling Machine.

Machine illustrated has 60 H. P. constant drilling capacity.

Consult Baush for solutions to your drilling, reaming, boring or tapping problems.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

VLIER TORQUE THUMB SCREWS

ARE SET TO GIVE YOU THE RIGHT END PRESSURES

Accepted by industry as the standard for use where positive, accurate holding tension is required against a Drilling or Mill Thrust, these popular units have replaced the old-style, costly conventional screws and "Spring Jacks." No more do you have to chance distortioning of machined parts or mis-alignment of surfaces while machining. Rejects and their attendant costs are eliminated, and uniform end pressures of from 10 to 22 lbs. are maintained, giving proper support at all times. Vlier Torque Thumb Screws with established end pressures, automatically adjusted at the factory, will also save up to 80% on fixture rework costs—no more distorted fragile jigs or fixtures.

As knurled knob of Vlier Torque Thumb Screw is turned, torque is applied which is transmitted to screw, until prescribed resistance is developed. At this point, ball in head construction as shown, is depressed into cavity and the applied torque to screw ceases and no further pressure can be applied. "Tight is tight enough."

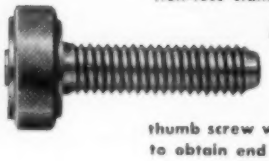
INVERTED TYPE B

This type is ideal for use where space is limited. Work is supported on end opposite screw section which now fits into tapped hole in fixture base.

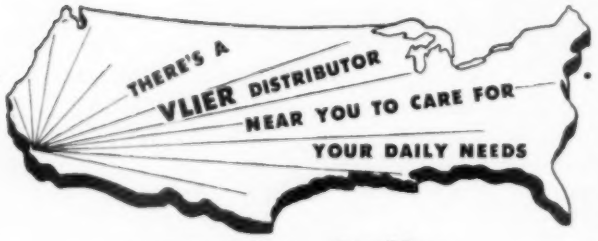
TEE HEAD TYPE C

This torque thumb screw is designed for use with sliding Vee Blocks. It offers the correct solution against springing castings or forgings with protruding arms. No forcing castings, etc., out of place while machining. Ideal for distortion-less clamping with accuracy assured.

ADJUSTABLE "SET YOUR OWN"



In addition to the Vlier Torque Thumb Screws which provide established end pressures, this latest adjustable type provides a torque thumb screw which tool engineers can set themselves to obtain end pressure they desire from 5 to 50 lbs.



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Helical Taper Pin Reamers Shipped by Return Mail

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The ASTE can help you for the simple reason, first of all, that its 18,000 members comprise those men **whose job it is to find new methods and equipment that will cut their companies' costs.**

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Top Management Executives.....	17 %
Production Executives.....	25 %
Master Mechanics; Process, Methods & Production Engineers, Etc.....	26 %
Chief Engineers, Development Engineers, Etc.....	18½%
TOOL ENGINEERS.....	**100%**

The booklet will tell you how many thousands of each there were . . . what kind of companies they represented . . . where they came from . . . what kind of products they came to see and buy.

And it tells you why EVEN MORE OF THE MEN WHO SPECIFY AND BUY will be at Philadelphia's Convention Hall & Commercial Museum next April 10th to 14th, looking for things that will cut their costs.

AMERICAN SOCIETY OF TOOL ENGINEERS

EXPOSITION COMMITTEE

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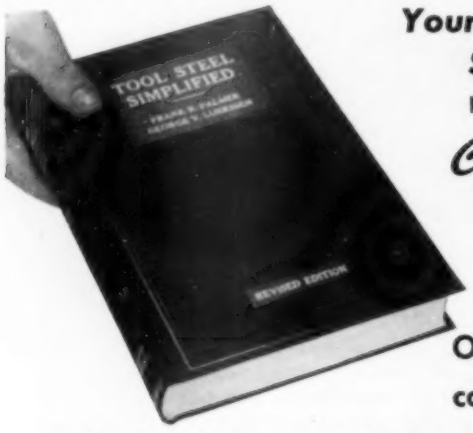

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4. The Character of Tool Steel
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Part II—Selecting the Right Tool Steel for Each Kind of Tool

6. The Matched Set Method
7. The Twelve Matched Tool Steels
8. The Matched Set Method in Use
9. The Tool Steel Selector

Part III—Properties, Heat Treatment and Testing of Tool Steel

10. Heat Treating Methods and Equipment
11. Hardness and Toughness Testing
12. Properties and Heat Treatment of Twelve Matched Tool Steels
13. High Speed and Hot Work Steels

Part IV—Things Worth Knowing

14. Relation of Design to Heat Treatment
15. The Hot Acid Etch Test
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Types to fit any machine used for tapping or reaming.

When you have a large number of tapping and reaming jobs involving a small number of parts, you can speed up the operation tremendously with a Ziegler Tool Holder because it greatly shortens set-up time.

Aligning the work with the spindle can be done much more quickly for the reason that with a Ziegler Holder the alignment does not have to be nearly so exact, the Ziegler Holder automatically compensating for inaccuracies up to 1/32" radius or 1/16" diameter.

Consequently, with a Ziegler Holder production can be under way much sooner than would be the case if the set-up were made with a tool holder requiring meticulous alignment of the work with the spindle. Try it some time and see for yourself!

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Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

Tool up Faster!

with

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Our line of carbide "standards" is complete. It covers 90% of all single-point operations. CARMET standard tools come ready to use . . . easy to modify for special purposes, by grinding. Style C, illustrated, is designed particularly for conversion into various shapes for numerous applications. Other standard CARMET styles also are immediately available from local stocks.

Order CARMET tools and blanks for better, faster, cheaper cutting. There is a grade to take care of every need.

WRITE FOR CATALOG C-2 . . . also for price list . . . great helps when you need tools fast.

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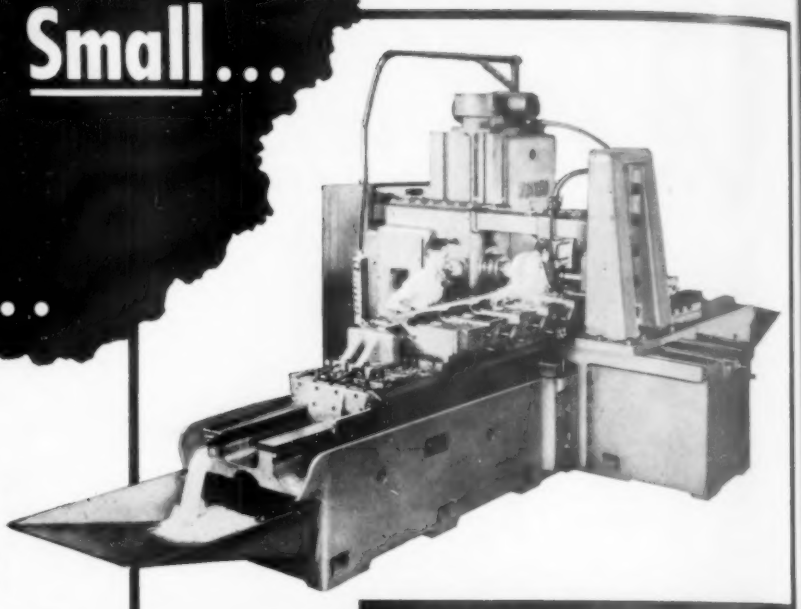
Distributors: Write us about handling CARMET Standard Tools in your area.

W&D 8706

For Big Jobs or Small... Simple or Complicated...



SIMPLEX RIGIDMILS

Either slab or face milling can be performed on this single spindle Rigidmil. This type machine can be furnished with 25, 30, 40, 50 or 75 horsepower heads. Table widths are 18″, 24″ or 30″ and table feed strokes up to 168 inches. Larger or special sizes are available on request.

You'll get better Milling Methods with SUNDSTRAND "Engineered Production" and Equipment

Here are some representative examples of machine tools, equipment and services offered by the Machine Tool Division of Sundstrand. Standard basic machine designs and units, coupled with methods engineering assistance, has resulted in many cost-saving Sundstrand installations. In addition to the basic standard unit type machine designs, you will find various attachments and accessories to speed up operations. All have been time-tested and proven in past performance. If you have metalworking operations in your plant and are interested in lowering manufacturing costs, call in a Sundstrand representative. He'll be glad to assist you in obtaining more economical methods. There is no obligation for this service.

DUPLEX RIGIDMILS

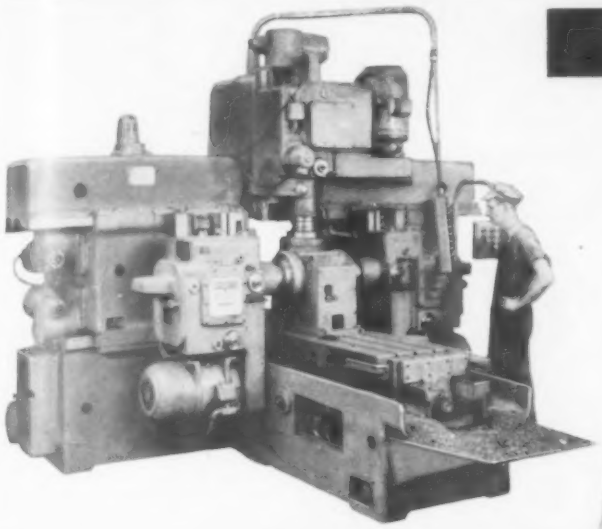
Machine has two horizontal opposed independently motor driven spindle heads which can be furnished in 15, 25, 30, 40 or 50 HP capacities. Table widths are 18″, 24″ or 30″ and table feed strokes up to 168 inches. Larger or special sizes are available on request.

Machine shown has spindle heads mounted on adjustable columns so as to handle a much wider range of work pieces. Power movement is provided for this column adjustment. A fixed column duplex type machine can be furnished if desired.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

RIGIDMILS • FLUID SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

TRIPLEX RIGIDMILS



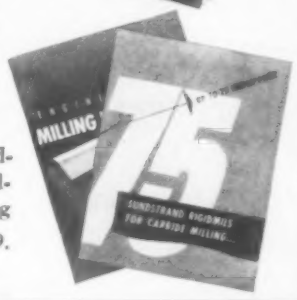
This highly productive Sundstrand Rigidmil has been developed to add flexibility to a production type milling machine so that both wide and narrow parts can be machined without sacrifice in accuracy. Three spindle heads, one vertical and two horizontal, can be adjusted to mill three sides of a work piece simultaneously or operate individually. Heads are independently motor driven and each can be furnished in either 15, 25 or 50 HP capacities. Machines can be furnished in table widths of 24″ and 30″ and feed strokes up to 168 inches with larger or special sizes available on request.

Magnetic *POWER-GRIP* Holding Methods and Devises

Illustrated above is a Model 22 Rigidmil equipped with a Power-Grip Magnetic Fixture for holding three shafts for a keyway milling operation. Use of a magnetic fixture not only simplified and speeded up the loading operation but reduced the cost of the work-holdng equipment over conventional holding methods. Magnetic fixtures are manufactured by the Sundstrand Magnetic Products Co. (formerly Rockford Magnetic Products Co.) which is now a division of the Sundstrand Machine Tool Co. Their Power-Grip Chucks are an easy solution to many work-holding problems. Their deep magnetic penetration eliminates the need for complex, expensive holding fixtures on either simple or odd shaped work pieces.
Write for bulletin number MC-789 on magnetic holding methods. Better still, send prints and specifications for our recommendations on Power-Grip holding equipment.

Additional Data

For more complete information on Sundstrand Simplex, Duplex and Triplex Rigidmils and Sundstrand Engineered Milling Methods, write for bulletins number 789.



Automatic Index Bases

Illustrated above is a standard Sundstrand Automatic Index Base mounted on a milling machine table. The base is provided with eight stations with two parts held in each station. Table cycling and indexing are automatic. Consequently, the operator merely loads and unloads two parts while two are being machined. Production is 800 pieces per hour. Standard Index Bases are available in sizes from 8″ to 30″ in diameter For more information, ask for bulletin number IB-789.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS U.S.A.

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ACCO

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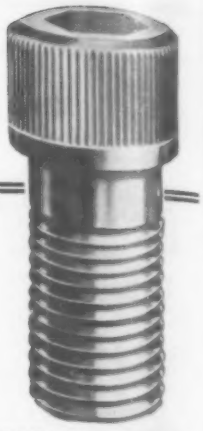
THE KNURLED HEAD...



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UNBRAKO

KNURLED SOCKET HEAD CAP SCREW

The *Knurled* Head of the "UNBRAKO" Socket Head Cap Screw does *triple* duty: (1) the *Knurling* provides a sure, slip-proof grip; (2) the *Knurling* speeds assembly because it enables the "UNBRAKO" to be screwed in faster and further with the fingers—handiest of all wrenches—before a "key" becomes necessary; (3) the *Knurling* permits positive locking. Available in both National Coarse and National Fine Thread Series in a full range of standard sizes. Other sizes to special order. Write us for your copy of the "UNBRAKO" Catalog and the name of your nearest "UNBRAKO" Distributor.

Other "UNBRAKO" Products include:

Self-Locking Socket Set Screws with Knurled Cup Points, Self-Locking Socket Set Screws with Knurled Threads, Self-Locking Square Head Set Screws with Knurled Cup Points, (all "Self-Lockers" that won't shake loose) Knurled Socket Head Stripper Bolts. *Precision-Ground* Dowel Pins. *Fully-Formed* Pressure Plugs.

Knurling of Socket Screws originated with "Unbrako" in 1934.

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A larger special fixture—four parts are clamped with one lever motion and machined from both sides by the two-way heads.

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Make every operator an expert

with "Packaged Engineering"

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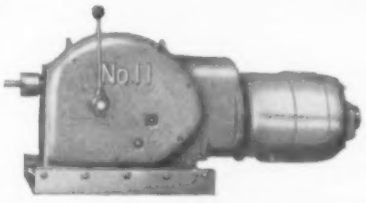
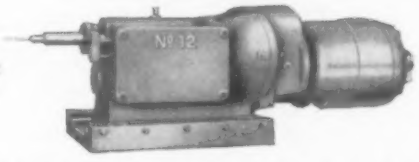
AUTOMATIC DRILLING & TAPPING MACHINES

This machine does 15 facing, drilling, reaming and tapping operations on a small part. Multiple spindle heads are used on some drilling and tapping units to accomplish two or more operations at a station.

Automatic Unit
No. 11 & 31



Lead Screw
Tapping Unit
No. 12 & 22



The spindles of all units are of alloy steel, heat treated and ground, mounted in anti-friction bearings. All gears are of heat treated alloy steel. Dovetail adapter plate with screw adjustment permits quick and accurate positioning.

Hartford Special Drilling and Tapping Machines are scientifically engineered to do all the "thinking" necessary to produce the finished pieces on a specific job. The operator's part is reduced to starting and stopping the machine, and loading and unloading the parts. Since his skill is not a factor, the finished pieces are of uniform accuracy and the high production rate is automatically maintained. The sequence of operations such as drilling, tapping, counterboring, milling, reaming, spotting, chamfering etc., is designed to require the minimum of time, space and maintenance. If your job requires a special single-purpose machine, it will be worth your while to investigate the "packaged engineering" Hartford Special has to offer. Why not write our Engineering Department now. The Hartford Special Machinery Co., Hartford 5, Connecticut.

HARTFORD Special

...the standard for special machinery

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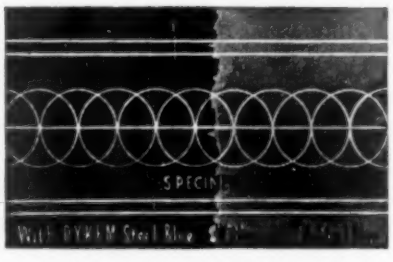
DYKEM STEEL BLUE

STOPS LOSSES

making dies & templates

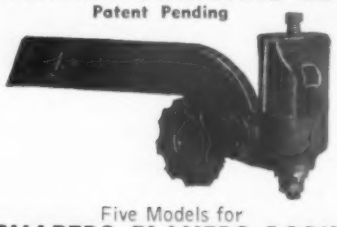


Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2303D North 11th St., St. Louis 6, Mo.
In Canada: 2466 Dundas St. West, Toronto, Ont.

Monarch Precision SHAPLANE Radius Tools
Patent Pending



Five Models for
LATHES, SHAPERS, PLANERS, BORING MILLS.

RANGE ½" To 3" RADIUS (MODELS ALSO AVAILABLE FOR CONVEX CUTTING AND FOR RADII to 6" ON PLANERS, ETC.)

C. B. TEETER
Tool Room Specialties
4470 Oakenwald Ave. Chicago 15, Ill.
Phone Drexel 3-3571

For Low-Cost Precision Measuring—

GRANITE SURFACE PLATES

Produced by Nature — Perfected by Herman Stone
Durable • Accurate • Economical

The inherent hardness and durability of granite, accurately finished to a guaranteed tolerance of .00005", provide the most efficient and economical surface plates for precision measurement operations. Sizes up to 8' x 16'.

★ *Non-Magnetic* ★ *Can Not Warp* ★ *Corrosion-proof*

Write for Free Trial Offer

THE HERMAN STONE COMPANY
324 Harries Bldg. • Dayton 2, Ohio

DRILL HARDENED STEEL WITH "HI-ROCKWELL" DRILLS WITHOUT ANNEALING

Every toolroom needs Ray-Metal "Hi-Rockwell" drills. These tools drill precision holes in steels testing C-40 to C-68 Rockwell quickly and without annealing. Ideal for reworking tools and dies, they actually cut a curled chip! *THEY CUT!!!*

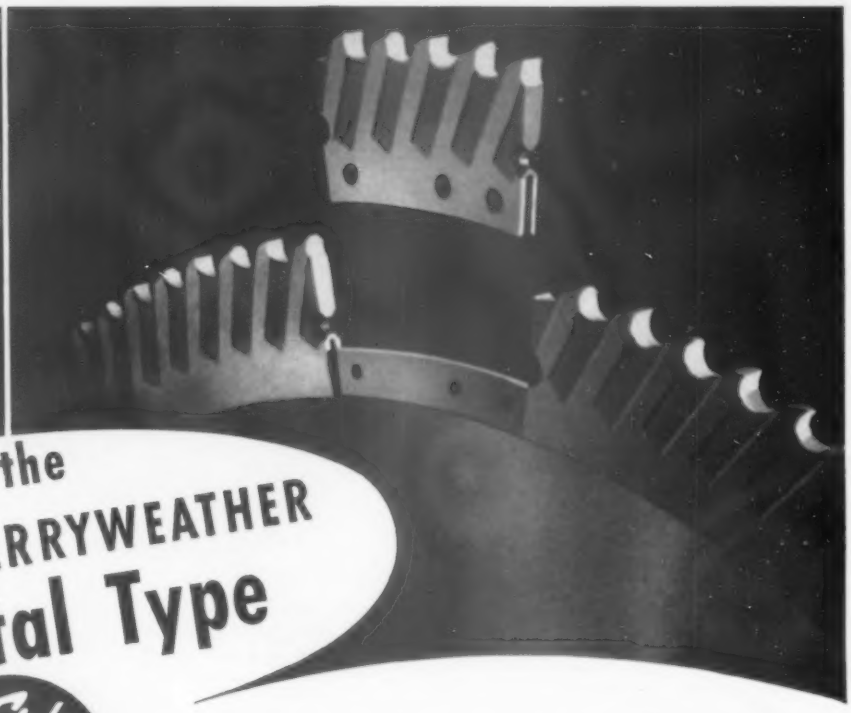
Sales territories open.

Available in standard sizes—order from:

RAY-METAL
RIGID-CARBIDE-TOOLS

9500 Carbon Street Detroit 17, Michigan

YOU CAN CUT OFF LARGE STOCK *More Cheaply, Quickly and Efficiently*



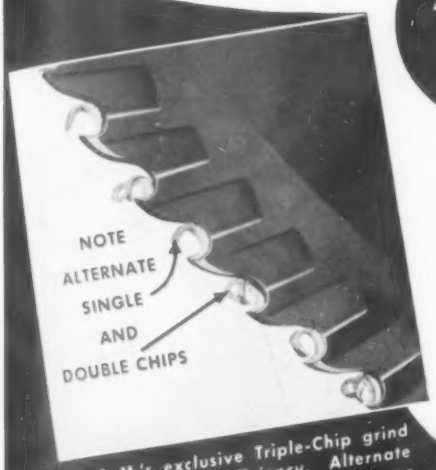
with the MOTCH & MERRYWEATHER Segmental Type

Triple-Chip Saw Blade

Triple-Chip saw blades of the segmental type from 11" through 70" diameter are recommended by Motch & Merryweather for cutting larger stock, because they produce faster cutting and smooth finish. Re-sharpening of segments permits many cuts per segment, and replaceability of segments makes possible continued use of the same disc... For most satisfactory results, use Motch & Merryweather blades with Motch & Merryweather circular sawing machines for cutting off stock up to 16½" diameter.

Ask for Bulletin 200-T

THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING • CLEVELAND 13, OHIO



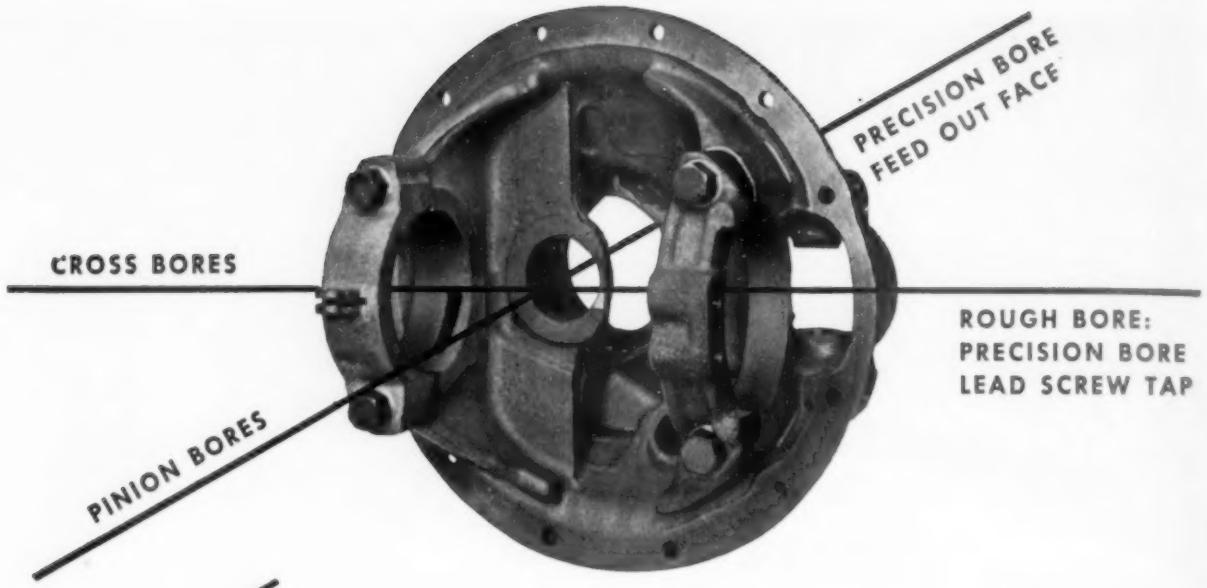
M. & M.'s exclusive Triple-Chip grind gives unrivalled efficiency. Alternate high and low teeth form one and two curling chips, respectively ("Hi-Lo" principle).

Rivets hold segment firmly to disc and overcome cutting pressure. Threaded dowel rivets maintain alignment. Coolant channels carry lubricant to cutting edges.

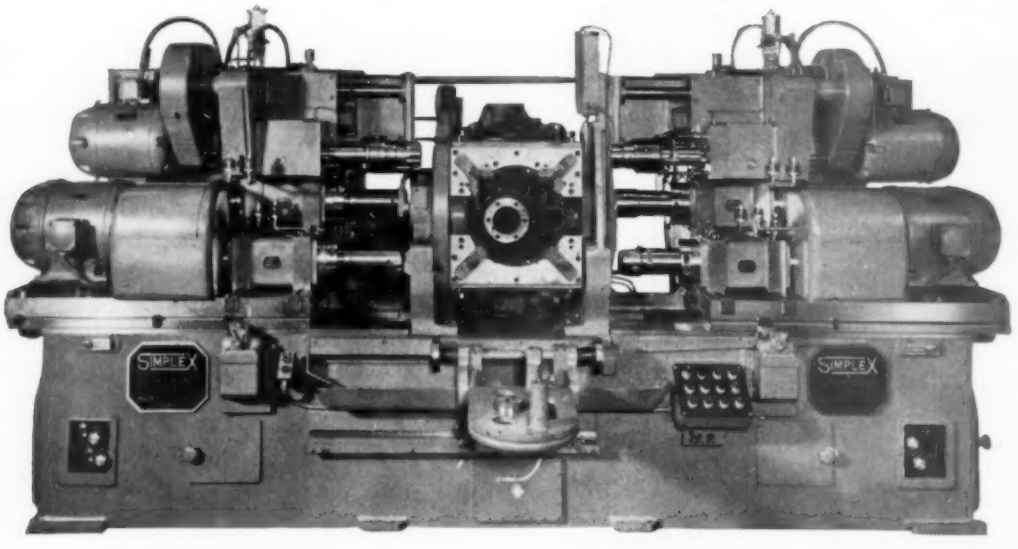
M. & M.'s sharpening method allows maximum number of cuts per blade. Blade can be re-fitted with new segments repeatedly without reducing diameter.

Tongue-and-groove construction insures exact fit. Projecting segments protect disc. Taper side clearance provides free cutting throughout life of segment.

AT YOUR COMMAND • AN UNPARALLELED EXPERIENCE IN CIRCULAR SAWING



MARKS THE SPOT WHERE *Precision Pays Off*



A Prominent Manufacturer of Axles greatly increased production, practically eliminated Axle tear down after assembly and lowered costs with these SIMPLEX 3-way Precision Boring Machines. A four-position indexing fixture permits loading on Station No. 1; Rough Boring Cross Bores on Station No. 2; Precision Boring Cross Bores, Pinion Bore and Feed Out Facing Pinion Bore on Station No. 3; Lead Screw Taping of Cross Bores on Station No. 4. A Production of 40 Carriers per Hour has been achieved on this large Truck type differential Carrier. Smaller Car Carriers would permit considerably higher production rates.

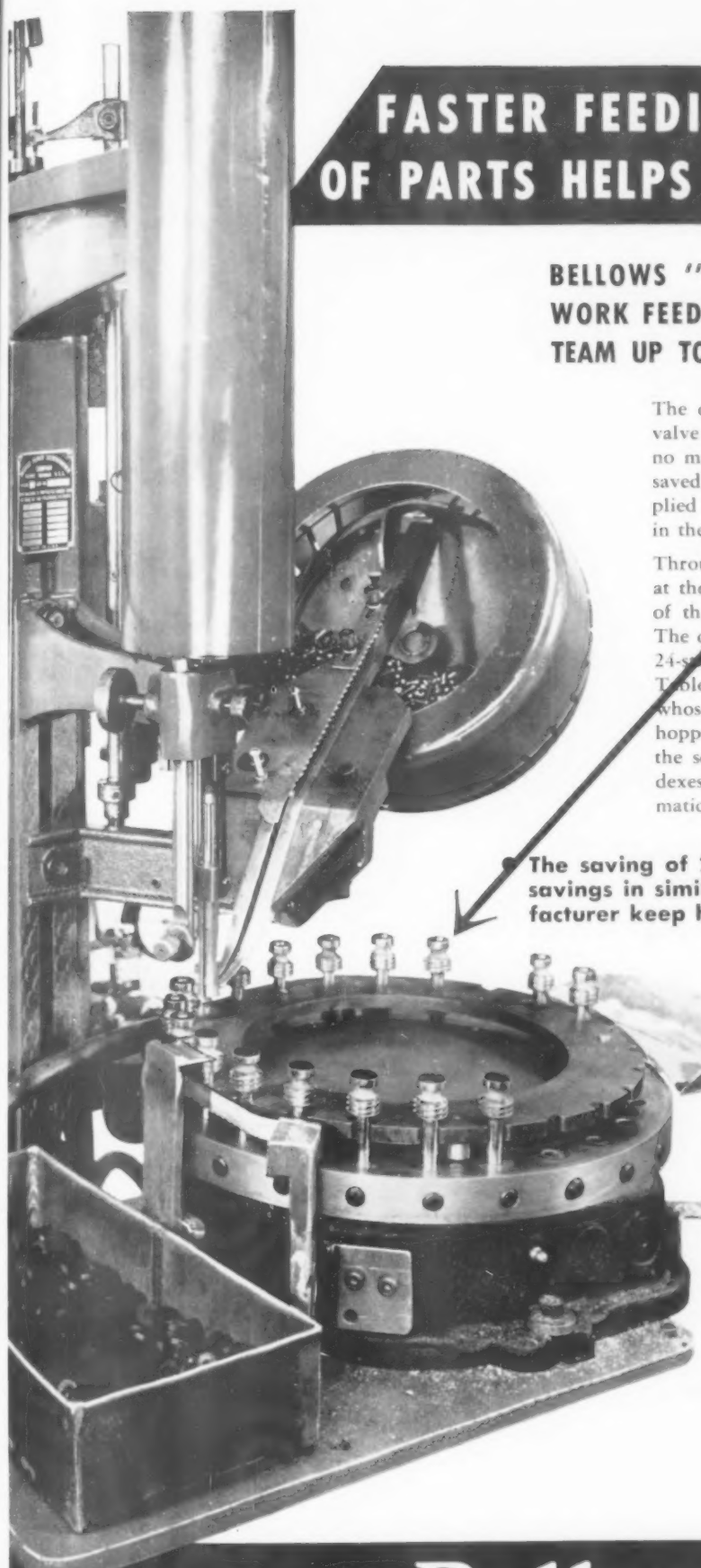
Simplex **PRECISION BORING MACHINES**

SIMPLEX MACHINE TOOL DIVISION
STOKERUNIT CORPORATION
4528 WEST MITCHELL STREET
MILWAUKEE, WISCONSIN

PRECISION BORING MACHINES • PLANER TYPE MILLING MACHINES • SPECIAL MACHINE TOOLS

FASTER FEEDING AND EJECTION OF PARTS HELPS CUT COSTS 25%

BELLOWS "CONTROLLED-AIR-POWER" ROTARY WORK FEED TABLE AND BELLOWS AIR MOTORS TEAM UP TO MAKE HAND OPERATION AUTOMATIC



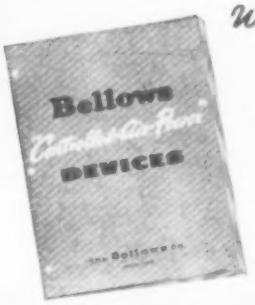
The cost of inserting the washer and screw in the valve stem of a water faucet isn't a major cost item, no matter how it's done. But a fraction of a penny saved here, a fraction of a penny saved there, multiplied by thousands of parts, adds up to major savings in the total cost picture.

Through the ingenious toolroom-built device shown at the left, a mid-western manufacturer cut the cost of this operation 25% under the old method used. The operator loads the valve stem and washer in the 24-station Bellows Rotary Work Feed Table. The Table positions the part under a power screw driver whose spindle is fed by a Bellows Air Motor. The hopper-fed screw is driven to correct pressure, and as the screw driver retracts the Rotary Feed Table indexes to the next position. A third Air Motor automatically ejects the part.

The saving of 25% in this operation, coupled with like savings in similar production processes helps this manufacturer keep his favorable competitive position.

YOU, TOO, CAN CUT PRODUCTION COSTS WITH BELLOWS "CONTROLLED-AIR-POWER"

No matter what you make chances are good there are places in your plant where Bellows Work Feed Tool Feeds, Bellows Air Motors, Bellows Work Holding Devices, and other Bellows "Controlled-Air-Power" Units can help you save important money.



Write for this

FREE BOOK

Or better yet, phone your local Bellows Field Engineer; ask him to bring you a copy of Bulletin CL-15. Let him show you how Bellows "Controlled-Air-Power" Devices are helping others beat the squeeze on profits.

The Bellows Co.

AKRON, OHIO

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BUSINESS OFF?

NOT AT WALES-STRIPPIT

THE EVENING N

OF THE TONAWANDAS — TWIN CITIES OF INDUSTRY ON THE NIAGARA FRONTIER

NORTH TONAWANDA-TONAWANDA, N. Y., THURSDAY, 1949

WALES-STRIPPIT EXPANDS PLANT CAPACITY

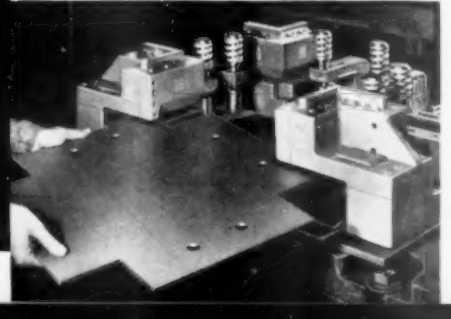
Will Permit Expanded Output of New Sheet-Metal Fabricator

Work started yesterday on an addition to the plant of the Wales-Strippit Corporation at 345 Payne Avenue, it was announced today by Company President Walter P. Hooper. It is hoped by the company that the addition will be completed in 90 days so that production of a new Wales-Strippit product may be materially expanded. This is a new sheet-metal fabricating machine which has electrified almost every industry that punches holes in metal, resulting in a big backlog of orders for

Swimmers Vie in 'Aquabatics' Events

A typical setup of Wales Type "BL" Hole Punching and Type "N" Notching Units on a T-slotted plate in a press brake for punching up to 1/8" thick mild steel.

A template setup of Wales Type "CJ" Hole Punching and Type "NJ" Notching Units in a stamping press for punching and notching up to 1/4" thick mild steel.



Wales Fabricator . . . The revolutionary [illegible] that has cut fabricating time from minutes to seconds.

● This plant expansion is a growing monument to the tooling ideas that have revolutionized the tooling industry. This larger "plant-of-ideas" brings you new hole punching and notching techniques with previously unheard of time-saving and money-saving advantages. Yes, there is always something new in the Wales line.

A GOOD RULE

Before deciding on the hole punching and notching portion of your tooling program, check with Wales-Strippit engineers who can solve your particular problems by using STANDARD adaptations of STANDARD Wales Equipment. Save your valuable time and effort in designing and building special hole punching and notching dies by calling on Wales-Strippit FIRST.

IT IS TOO BIG A STORY to tell on this page . . . so write today for fully-illustrated, functionally-colored catalogs.

WALES-STRIPPIT CORPORATION

George F. Wales, Chairman

393 PAYNE AVENUE, NORTH TONAWANDA, N. Y.

(Between Buffalo and Niagara Falls)

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONTARIO

Specialists in Punching and Notching Equipment